National Aeronautics and Space Administration
Langley Research Center

Scientific and Technical Information Program Office

Scientific and Technical Aerospace Reports

STAR

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NASA STI Program ... in Profile

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  NASA Center for AeroSpace Information
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Introduction

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STAR subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and application, as well as aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation and other topics of high national priority. The listing is arranged first by 11 broad subject divisions, then within these divisions by 76 subject categories and includes two indexes: subject and author.

STAR includes citations to Research & Development (R&D) results reported in:

- NASA, NASA contractor, and NASA grantee reports
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- Translations
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses

The NASA STI Program

The NASA Scientific and Technical Information (STI) Program was established to support the objectives of NASA's missions and research to advance aeronautics and space science. By sharing information, the NASA STI Program ensures that the U.S. maintains its preeminence in aerospace-related industries and education, minimizes duplication of research, and increases research productivity.

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Through NASA CASI, the NASA STI Program offers many information products and services to the aerospace community and to the public, including access to a selection of full text of the NASA STI. Free registration with the program is available to NASA, U.S. Government agencies and contractors. To register, contact CASI at help@sti.nasa.gov. Others should visit the program at www.sti.nasa.gov. The 'search selected databases' button provides access to the NASA Technical Reports Server (TRS) – the publicly available contents of the NASA Aeronautics and Space Database.

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National Technical Information Service (NTIS)

The National Technical Information Service serves the American public as a central resource for unlimited, unclassified U.S. Government scientific, technical, engineering, and business related information. For more than 50 years NTIS has provided businesses, universities, and the public timely access to well over 2 million publications covering over 350 subject areas. Visit NTIS at http://www.ntis.gov.

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The U.S. Patent and Trademark Office (USPTO)

The U.S. Patent and Trademark Office provides online access to full text patents and patent applications. The database includes patents back to 1976 plus some pre-1975 patents. Visit the USPTO at http://www.uspto.gov/patft/.

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Subject Term Index

Personal Author Index

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

A Biweekly Publication of the National Aeronautics and Space Administration

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01
AERONAUTICS (GENERAL)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft. For specific topics in aeronautics, see *categories 02 through 09*. For information related to space vehicles *see 12 Astronautics*.

20030112888 Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China
Journal of Nanjing University of Aeronautics and Astronautics, Volume 35, Number 3, 2003
Dewang, L.; Jun. 2003; 130 pp.; In Chinese
Report No.(s): PB2004-100909; No Copyright; Avail: CASI; A07, Hardcopy

Contents include the following: Some Doubts in Helicopter Aerodynamics; Investigation of Helicopter Longitudinal Control Response Based on ADS-33 Requirements; Design and Experiment of Lift Transfer in Scheme of High-Speed Helicopter; Prediction of Aerodynamic Interactions of Helicopter Fuselage on its Rotor; Aeroelastic Stability Analysis of Helicopter Rotor Blade with Swept Tips; Experimental Research on Adaptive Internal Model Control Simulation for Helicopter Cabin Noise; A Method for Designing Attitude Controller Based on Fuzzy Control; Ground Resonance Analysis of Helicopter with Magnetorheological Lag Damper; Unsteady Rotor Airload Prediction using a Comprehensive Aeroelastic Analysis; Theoretical Analysis of Rotational Noise in Hovering Rotors; Flight Dynamics Model and Stability Augment Design for a Small-Size Unmanned Helicopter; On-off Control for Ground Resonance of Helicopter using Inter-Connected Blade Magnetorheological Dampers; A Time-Domain Methodology for Identifying Model Parameters of Elastomeric Lag Dampers; Some Problems on Active Control of Structural Vibration for Helicopter; Influence of Downwash Flow on Launching Missile on Armed Helicopter Main Rotor; Experimental Study of Rotor Unsteady Aerodynamic Loads; Active Sliding Model Control of Vibration in a Class of Nonlinear Systems; Improvements of a Finite Volume Method for Euler Equations on Unstructured Meshes; Experimental Research of Jettison of Aircraft External Store in Low Speed Wind Tunnel; Aerodynamic Optimization Design of Micro Air Vehicle Propeller; Research of Multi-Restrict Airline Schedule Optimization Model and Method; Filament Winding Pattern Design for Composite Elbow; and Advances in Computational Fluid Dynamics of Helicopter Rotor. NTIS

Aeronautics; Astronautics; Helicopters

20030112893 Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China
Journal of Nanjing University of Aeronautics and Astronautics, Volume 34, Number 4, 2002
Dewang, L.; Jun. 2003; 104 pp.; In Chinese
Report No.(s): PB2004-100910; No Copyright; Avail: CASI; A06, Hardcopy

Contents: An Outlook on the Infinity (N)-Natural Number System and Infinity Axiom; An Outlook on the Infinity (V)-An Axiomatic Set Theory APAS for Holding the Actual Infinity and the Potential Infinity Concurrently; Experimental Study in a Jet Boundary Impinging on a Bent Plate; Studies on Nonparallelism of Boundary Layer Stability; Experimental Research on Jet Electroforming; New Tool Path Generation Algorithm for Three-Axis NC Machining Based on Solid Model; Realization of Manufacturing Execution System Based on CORBA; Matching Product Family for Mass Customization Design; EDM Numerical Control System; General Types of Planar Five-Bar Mechanism and its Kinematic Modeling; Grey Superior Analysis of Multi-Radar Low-Altitude Little Target Tracking System; Application Analysis of Circle Orbit Synchronous Satellite in Regional Navigation System; DDM Implementation Strategy and Optimizing Cell Size; Multi-Classifier Decision Fusion Based Seal Imprint Verification Approach; Intelligent System for Noninvasive Measurement of Blood Oxygen Saturation; Real-Time Simulational System using Neural Network Based on DSP; Flight Path Planning based on Digital Map Preprocessing; Design of Flight/Thrust Integrated Control System using LMI-Based H-Synthesis; Realization of Eliminating Distortion and Twist of Scale Lines in Compass; New Method of Attitude Estimation based on GPS; and

Real-Time Simulational Model for High Fidelity Engineering Simulator of Rotorcraft.
NTIS
Aeronautics; Astronautics

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; airport ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in *09 Research and Support Facilities (Air)*. Air traffic control is covered in *04 Aircraft Communications and Navigation*. For related information see also *16 Space Transportation and Safety* and *85 Technology Utilization and Surface Transportation*.

20030112975 Task Consulting, Dayton, OH, USA
Aerospace Transparency Research Compendium
Pinkus, Alan R.; Task, Harry L.; Barbato, Maryann H.; Hausmann, Martha A.; Dixon, Sharon A.; Jun. 2003; 247 pp.; In English
Contract(s)/Grant(s): F33615-98-D-6000; Proj-7184
Report No.(s): AD-A418282; AFRL-HE-WP-TR-2003-0084; No Copyright; Avail: CASI; A11, Hardcopy

For nearly 30 years, the Crew System Interface Division (HEC; www.hec.afrl. af.mil) of the Air Force Research Laboratory (ARRL), located at Wright-Patterson AFB OH, has advanced aerospace transparency technology through the investigative research of numerous optical and visual parameters inherent in aerospace transparencies. This document contains reprints of four publications by AFRL/ HEC, which provide an overview of various optical characteristics, visual effects and other issues associated with aircraft transparencies. Also included is an annotated bibliography of in-house publications, a bibliography of additional transparency-related publications plus listings of standardized test methods and related patent abstracts.
DTIC
Aerospace Systems; Technology Assessment; Standardization; Optical Properties

20030113191 Old Dominion Univ., Norfolk, VA, USA
Validation of Variations in Mental Workload as a Function of Scenario Difficulty: Traffic Density and Visibility
[2003]; 10 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG1-03020; Proj. 131881; No Copyright; Avail: CASI; A02, Hardcopy

Fluctuations in mental workload can be expected as a function of traffic density and visibility. The aim of the current investigation was to establish simulation scenarios that differed in attentional processing requirements. Four scenarios were created and tested representing two levels of traffic density (urban versus freeway) and two levels of visibility (clear versus foggy). An array of mental workload assessment measures were used to exam changes in attentional processing requirements in each scenario. The assessment array consisted of physiological (P300 amplitude and latency) and behavioral (RT and accuracy) indices. Preliminary results indicate that workload differs significantly as a function of traffic density in rural versus freeway scenarios. Workload also differs significantly in rural versus freeway scenarios as a function of visibility as observed by a significant interaction between the two variables of interest. Results are discussed in terms of their application for validating the difficulty level of simulation scenarios as a format for examining mental workload.
Author
Visibility; Workloads (Psychophysiology); Computerized Simulation; Air Traffic; Mental Performance

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information see also *18 Spacecraft Design, Testing and Performance*; and *39 Structural Mechanics*. For land transportation vehicles see *85 Technology Utilization and Surface Transportation*.

20030112961 Naval Postgraduate School, Monterey, CA
A Simulation of the I3 to D Repair Process and Sparing of the F414-GE-400 Jet Aircraft Engine
Schoch, Eric J.; Sep. 2003; 171 pp.; In English; Original contains color illustrations
Report No.(s): AD-A418270; No Copyright; Avail: CASI; A08, Hardcopy

The F/A-18E/F is the latest multi-mission tactical aircraft to enter USA Naval Service. it generates power via two F414-GE-400 engines, each of which is composed of six modules. In addition to a new aircraft model and engines, a new concept, the 13 to D Repair Process, is being used for F414-GE-400 module and engine repair. in the 13 to D Repair Process, the intermediate level no longer repairs modules. instead, the depot level performs all module repairs. This thesis develops and exercises a simulation of the 13 to D Repair Process for the F414-GE-400 by incorporating simulated F/A-18E/F flight schedules and engine failures to populate the repair cycle. The simulation provides operational availability (A0) and probability to spare the repair process given an infrastructure and sparing profile. Three previous years of module failures and depot repair times are used to calibrate the model. Simulation results for the baseline studied showed the distinct influence of certain input parameters.

DTIC

Aircraft Engines; Jet Engines; Simulation; Maintenance

07
AIRCRAFT PROPULSION AND POWER

Includes primary propulsion systems and related systems and components, e.g., gas turbine engines, compressors, and fuel systems; and onboard auxiliary power plants for aircraft. For related information see also *20 Spacecraft Propulsion and Power; 28 Propellants and Fuels*; and *44 Energy Production and Conversion*.

20030112863 NASA Glenn Research Center, Cleveland, OH, USA

Embedded Wing Propulsion Conceptual Study

Kim, Hyun D.; Saunders, John D.; November 2003; 17 pp.; In English; Vehicle Propulsion Integration Symposium, 6-9 Oct. 2003, Warsaw, Poland; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 22-708-87-19

Report No.(s): NASA/TM-2003-212696; E-14199; NAS 1.15:212696; No Copyright; Avail: CASI; A03, Hardcopy

As a part of distributed propulsion work under NASA's Revolutionary Aeropropulsion Concepts or RAC project, a new propulsion-airframe integrated vehicle concept called Embedded Wing Propulsion (EWP) is developed and examined through system and computational fluid dynamics (CFD) studies. The idea behind the concept is to fully integrate a propulsion system within a wing structure so that the aircraft takes full benefits of coupling of wing aerodynamics and the propulsion thrust stream. The objective of this study is to assess the feasibility of the EWP concept applied to large transport aircraft such as the Blended-Wing-Body aircraft. In this paper, some of early analysis and current status of the study are presented. In addition, other current activities of distributed propulsion under the RAC project are briefly discussed.

Author

Blended-Wing-Body Configurations; Aircraft Engines; Aerodynamics; Engine Airframe Integration

20030113049 Tennessee Univ. Space Inst., Tullahoma, TN, USA

Pulsed Ejector Wave Propogation Test Program

Fernandez, Rene; Slater, John W.; Paxson, Daniel E.; Confined Detonations and Pulse Detonation Engines; February 28, 2003, pp. 311-334; In English

Contract(s)/Grant(s): 708-48-13; Copyright; Avail: Other Sources

The development of, and initial test data from, a nondetonating Pulse Detonation Engine (PDE) simulator tested in the NASA Glenn 1 x 1 foot Supersonic Wind Tunnel (SWT) is presented in this paper. The concept is a pulsed ejector driven by the simulated exhaust of a PDE. This pro- gram is applicable to a PDE entombed in a ramjet flowpath, i.e., a PDE combined-cycle propulsion system. The ejector primary flow is a pulsed, uiiderexpanded, supersonic nozzle simulating the supersonic waves ema- nating from a PDE, while the ejector secondary flow is the 1 x 1 foot SWT test section operated at subsonic Mach numbers. The objective is not to study the detonation details, but the wave physics including t,he start- ing vortices, the extent of propagation of the wave front, the reflection of the wave from the secondary flowpath walls, and the timing of these events of a pulsed ejector, and correlate these with Computational Fluid Dynamics (CFD) code predictions. Pulsed ejectors have been shown to result in a 3 to 1 improvement in LID (length-to-diameter) and a near 2 to 1 improvement in thrust augmentation over a steady ejector. This program will also explore the extent of upstream interactions between an inlet and large, periodically applied, backpressures to the inlet as would be present due to combustion tube detonations in a PDE. These interactions could result in inlet unstart or buzz for a supersonic mixed compression inlet. The design of the present experiment entailed the use of an 2-t diagram characteristics code to study the nozzle filling and purging timescales as well as a series of CFD analyses conducted using the WIND code. The WIND code is a general purpose CFD code for

solution of the Reynolds averaged Navier-Stokes equations and can be applied to both steady state and time-accurate calculations. The first, proof-of-concept, test entry (spring 2001) pressure distributions shown here indicate the simulation concept was successful and therefore the experimental approach is sound.
Author
Pulse Detonation Engines; Ejectors

08
AIRCRAFT STABILITY AND CONTROL

Includes flight dynamics, aircraft handling qualities, piloting, flight controls, and autopilots. For related information see also *05 Aircraft Design, Testing and Performance* and *06 Avionics and Aircraft Instrumentation*.

20030112874 NASA Dryden Flight Research Center, Edwards, CA, USA
Integration of Online Parameter Identification and Neural Network for In-Flight Adaptive Control
Hageman, Jacob; Smith, Mark; Stachowiak, Susan; [2003]; 16 pp.; In English; AIAA Atmospheric Flight Mechanics Conference and Exhibit, 11-14 Aug. 2003, Austin, TX, USA; Original contains color and black and white illustrations
Report No.(s): AIAA Paper 2003-5700; Copyright; Avail: CASI; A03, Hardcopy

An indirect adaptive system has been constructed for robust control of an aircraft with uncertain aerodynamic characteristics. This system consists of a multilayer perceptron pre-trained neural network, online stability and control derivative identification, a dynamic cell structure online learning neural network, and a model following control system based on the stochastic optimal feedforward and feedback technique. The pre-trained neural network and model following control system have been flight-tested, but the online parameter identification and online learning neural network are new additions used for in-flight adaptation of the control system model. A description of the modification and integration of these two stand-alone software packages into the complete system in preparation for initial flight tests is presented. Open-loop results using both simulation and flight data, as well as closed-loop performance of the complete system in a nonlinear, six-degree-of-freedom, flight validated simulation, are analyzed. Results show that this online learning system, in contrast to the nonlearning system, has the ability to adapt to changes in aerodynamic characteristics in a real-time, closed-loop, piloted simulation, resulting in improved flying qualities.
Author
Adaptive Control; Aircraft Control; Neural Nets; Systems Integration; Control Systems Design; Parameter Identification

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see *03 Air Transportation and Safety*. For astronautical facilities see *14 Ground Support Systems and Facilities (Space)*.

20030112897 National Aerospace Lab., Tokyo
Technical Report of National Aerospace Laboratory Management for the NAL 1.27m Hypersonic Wind Tunnel
Nagai, S.; Tsuda, S.; Koyama, T.; Hirabayashi, N.; Sekine, H.; 2001; 18 pp.; In Japanese
Report No.(s): PB2004-100467; NAL-TR-1436; Copyright; Avail: National Technical Information Service (NTIS)

Variation of pilot pressure was observed in a Mach 10 nozzle calibration test of the National Aerospace Laboratory 1.27m hypersonic wind tunnel immediately after a humid combustion gas evacuation system was added to the air heater. The mix of humidity provided by condensed water inside the tunnel structure was evaluation using run-by-run variations of evacuated heater pressure and of measured humidity level in the working air. The calibration data were also examined and a non-isentropic condensing flow through the nozzle was believed to have occurred. Thus modifications to prevent condensing of water were carried out and constant pitot pressure was obtained in a further calibration test. A statistical assessment was made of the data obtained before and after these modifications, and the results were compared to confirm the existence of a repeatable isentropic flow. This allowed efficient humidity management within the operation cycle. The water-effect free flow was assured by monitoring the humidity level and nozzle exit wall pressure.
NTIS
Hypersonic Wind Tunnels; Humidity

20030113124 NASA Glenn Research Center, Cleveland, OH, USA, QSS Group, Inc., USA

Dual-Spool Turbine Facility Design Overview

Giel, Paul; Pachlhofer, Pete; May 1, 2003; 20 pp.; In English; AIAA TETWOG Meeting, 1-2 May 2003, Cincinnati, OH, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS3-00145; WBS 22-714-03-58; No Copyright; Avail: CASI; A03, Hardcopy

The next generation of aircraft engines, both commercial and military, will attempt to capitalize on the benefits of close-coupled, vaneless, counter-rotating turbine systems. Experience has shown that significant risks and challenges are present with close-coupled systems in terms of efficiency and durability. The UEET program needs to demonstrate aerodynamic loading and efficiency goals for close-coupled, reduced-stage HP/LP turbine systems as a Level 1 Milestone for FY05. No research facility exists in the U.S. to provide risk reduction for successful development of close-coupled, high and low pressure turbine systems for the next generations of engines. To meet these objectives, the design, construction, and integrated systems testing of a Dual-Spool Turbine Facility (DSTF) facility has been initiated at the NASA Glenn Research Center. The facility will be a warm (-IOOO'F), continuous flow facility for overall aerodynamic performance and detailed flow field measurement acquisition. The facility will have state-of-the-art instrumentation to capture flow physics details. Accurate and reliable speed control will be achieved by utilizing the existing Variable Frequency Drive System. Utilization of this and other existing GRC centralized utilities will reduce the overall construction costs. The design allows for future installation of a turbine inlet combustor profile simulator. This presentation details the objectives of the facility and the concepts used in specifying its capabilities. Some preliminary design results will be presented along with a discussion of plans and schedules. Author

Aerodynamic Characteristics; Aerodynamic Loads; Aircraft Engines; Construction; Combustion Chambers; Research Facilities; Design Analysis

12
ASTRONAUTICS (GENERAL)

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see *categories 13 through 20*. For extraterrestrial exploration see *91 Lunar and Planetary Science and Exploration*.

20030112985 Connecticut Univ., Storrs, CT, USA

New Polymers and Processes for Space Applications

Mather, Patrick T.; Nov. 5, 2003; 9 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0100; Proj-2303

Report No.(s): AD-A418326; AFRL-SR-AR-TR-03-0474; No Copyright; Avail: CASI; A02, Hardcopy

The overall objective of this proposal was to conceive and develop new polymeric materials and processes for emerging Air Force applications that are space-based. Specifically, we developed new thermoset materials, including nanostructured and liquid crystalline thermosets, with enhanced use temperature and fracture toughness beyond state- of-practice materials. Additionally, we developed new polymer processing methods to achieve concave polymer films with tailored shape. Three distinct thermosetting systems were compared in terms of viability for combined Tg and fracture toughness enhancement, while maintaining or improving processability over state-of-the-art resin systems. The particular systems studied include: (i) epoxy resins modified by inorganic-organic hybrid POSS compounds, (ii) liquid crystalline thermosents, and (iii) reactive hyperbranced polymeric additives for bismaleimide-polyhedral oligomeric silsesquioxane (BMI-POSS) epoxies. During this program, two graduate assistants were supported, Mr. Haihu Qin (full support) and Mr. Jian Wu (partial support), as well as a postdoctoral researcher, Dr. Gyeong-Man Kim (full support); all through whom significant progress has been made.
DTIC

Technology Assessment; Product Development; Space Technology Experiments; Fracture Strength; Bismaleimide

15
LAUNCH VEHICLES AND LAUNCH OPERATIONS

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also *18 Spacecraft Design, Testing and Performance*; and *20 Spacecraft Propulsion and Power*.

20030112884 National Aerospace Lab., Tokyo

Technical Report of National Aerospace Laboratory. Teleoperation with Time Delay. A Survey and Its Use in Space Robotics

Penn, L. F.; Matsumoto, K.; Feb. 2003; 34 pp.; In English

Report No.(s): PB2004-100469; NAL-TR-1438T; Copyright; Avail: National Technical Information Service (NTIS)

The existence of time delay in the communication link is one of the most important problems regarding the stability of teleoperation systems. Space robot systems and on-orbit telerobotics technology will play an essential role in the construction and maintenance of large-scale structures, such as the International Space Station (ISS), but it is well known that in Earth orbit space applications the total cycle time is usually of 7 s. Many proposals have appeared in the literature through the years on how to conduct time-delayed teleoperation, but to date no comprehensive comparison study between them has been carried out. In this context, we decided to conduct a survey of all the proposals for time-delayed teleoperation present so far in the literature and compare them on the same grounds. This will give researchers in this field a better understanding of the problem and will help them have a clear view as to in what areas more research is needed to achieve continuous and smooth teleoperation in the presence of time delay. We have focused our study on the continuous teleoperation of robotic arms on orbit around the Earth. This will be the area of space robotics applications with the greatest demand in the following years. Special emphasis has been put throughout the study on the specific operational characteristics of this type of system. Finally, we have proposed a framework for future research in the field. The framework is based on the definition of a nomenclature and a data flow diagram in which to express in a concise and compact way different algorithms. The utility of this framework is demonstrated both with a general example and with its application to different proposals present in the literature.

NTIS

Robotics; Remote Control; Space Stations; Telerobotics

20
SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 15 Launch Vehicles and Launch Operations*, and *44 Energy Production and Conversion*.

20030112954 Toledo Univ., OH, USA

Next Generation of Hall Thrusters for Space Propulsion

Keith, Theo G., Jr.; Manzella, David; December 2003; 5 pp.; In English

Contract(s)/Grant(s): NCC3-855; No Copyright; Avail: CASI; A01, Hardcopy

During the previous year, grant activity research focused on demonstrating high thrust/power operation of Hall thrusters. Performance of a low power and a high power Hall thruster was experimentally investigated at discharge voltages from 100 to 150 volts. Discharge efficiencies dropped significantly as discharge voltage was decreased over this range. Reductions in discharge efficiency with decreasing discharge voltage were attributed to reductions in ionization efficiency and/or ion acceleration through a potential less that the applied discharge voltage relative to the performance of state-of-art Hall thrusters operating at discharge voltages of 300 Volts and above. The low power Hall thruster exhibited a more pronounced reduction in discharge efficiency with decreasing discharge voltage. This was attributed to increased electron leakage related to the axial distribution of the radial magnetic field. These data demonstrated that the thrust benefit of operating at discharge voltages below 130 Volts was offset by a corresponding decrease in discharge efficiency for a given input power. Additional activities included continued support of on-going Hall thruster propulsion research within the On-Board Propulsion Branch at NASA Glenn Research Center.

Author

Hall Thrusters; Spacecraft Propulsion; Spacecraft Configurations; Electric Propulsion; Technology Utilization

20030113128 NASA Glenn Research Center, Cleveland, OH, USA

Vibration Testing of Stirling Power Convertors

Hughes, Bill; Goodnight, Thomas; McNelis, Mark E.; Suarez, Vicente J.; Schreiber, Jeff; Samorezov, Sergey; [2003]; 2 pp.; In English; AIAA/ICAS International Air and Space Symposium and Exposition: The Next 100 Years, 14-17 Jul. 2003, Dayton, OH, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 22-979-30-01; No Copyright; Avail: Other Sources; Abstract Only

The NASA John H. Glenn Research Center (GRC) and the U.S. Department of Energy (DOE) are currently developing a high efficient, long life, free piston Stirling convertor for use as an advanced spacecraft power system for future NASA missions. As part of this development, a Stirling Technology Demonstrator Convertor (TDC), developed by Stirling Technology Company (STC) for DOE, was vibration tested at GRC s Structural Dynamics Laboratory (SDU7735) in November- December 1999. This testing demonstrated that the Stirling TDC is able to withstand the harsh random vibration (20 to 2000 Hertz) seen during a typical spacecraft launch and survive with no structural damage or functional power performance degradation, thereby enabling its usage in future spacecraft power systems. The Stirling Vibration Test Team at NASA GRC and STC personnel conducted tests on a single 55 electric watt TDC. The purpose was to characterize the TDC s structural response to vibration and determine if the TDC could survive the vibration criteria established by the Jet Propulsion Laboratory (JPL) for launch environments. The TDC was operated at full-stroke and full power conditions during the vibration testing. The TDC was tested in two orientations, with the direction of vibration parallel and perpendicular to the TDC s moving components (displacer and piston). The TDC successfully passed a series of sine and random vibration tests. The most severe test was a 12.3 Grms random vibration test (peak vibration level of 0.2 g2/Hz from 50 to 250 Hertz) with test durations of 3 minutes per axis. The random vibration test levels were chosen to simulate, with margin, the maximum anticipated launch vibration conditions. As a result of this very successful vibration testing and successful evaluations in other key technical readiness areas, the Stirling power system is now considered a viable technology for future application for NASA spacecraft missions. Possible usage of the Stirling power system would be to supply on- board electric spacecraft power for future NASA Deep-Space Missions, performing as an attractive alternative to Radioisotope Thermoelectric Generators (RTG). Usage of the Stirling technology is also being considered as the electric power source for future Mars rovers, whose mission profiles may exclude the use of photovoltaic power systems (such as exploring at high Martian latitudes or for missions of lengthy durations). GRC s Thermo-Mechanical Systems Branch (5490) provides Stirling technology expertise under a Space Act Agreement with the DOE. Additional vibration testing, by GRC s Structural Systems Dynamics Branch (7733, is planned to continue to demonstrate the Stirling power system s vibration capability as its technology and flight system designs progress.

Author

Vibration Tests; Converters; Dynamic Response; Dynamic Structural Analysis

20030113133 NASA Marshall Space Flight Center, Huntsville, AL, USA

Nucleation Behavior of Oxygen-Acetylene Torch-Produced Diamond Films

Roberts, F. E.; November 2003; 1 pp.; In English

Report No.(s): NASA/TP-2003-212929; M-1094; No Copyright; Avail: Other Sources; Abstract Only

A mechanism is presented for the nucleation of diamond in the combustion flame environment. A series of six experiments and two associated simulations provide results from which the mechanism was derived. A substantial portion of the prior literature was reviewed and the data and conclusions from the previous experimenters were found to support the proposed mechanism. The nucleation mechanism builds on the work of previous researchers but presents an approach to nucleation in a detail and direction not fully presented heretofore. This work identifies the gas phase as the controlling environment for the initial formation steps leading to nucleation. The developed mechanism explains some of the difficulty which has been found in producing single crystal epitaxial films. An experiment which modified the initial gas phase precursor using methane and carbon monoxide is presented. Addition of methane into the precursor gases was found to be responsible for pillaring of the films. Atomic force microscopy surface roughness data provides a reasonable look at suppression of nucleation by carbon monoxide. Surface finish data was taken on crystals which were open to the nucleation environment and generally parallel to the substrate surface. The test surfaces were measured as an independent measure of the instantaneous nucleation environent. A gas flow and substrate experiment changed the conditions on the surface of the sample by increasing the gas flow rate while remaining on a consistent point of the atomic constituent diagram, and by changing the carbide potential of the substrate. Two tip modification experiments looked at the behavior of gas phase nucleation by modifying the shape and behavior of the flame plasma in which the diamond nucleation is suspected to occur. Diamond nucleation and growth was additionally examined

using a high-velocity oxygen fuel gun and C3H6 as the fuel gas phase precursor with addition of carbon monoxide gas 01 addition of liquid toluene.
Author
Nucleation; Diamond Films; Combustion Physics; Oxygen; Acetylene

24
COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

20030112866 NASA Glenn Research Center, Cleveland, OH, USA
A Model for the Oxidation of C/SiC Composite Structures
Sullivan, Roy M.; November 2003; 20 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 22-706-85-04
Report No.(s): NASA/TM-2003-212720; E-14244; No Copyright; Avail: CASI; A03, Hardcopy

A mathematical theory and an accompanying numerical scheme have been developed for predicting the oxidation behavior of C/SiC composite structures. The theory is derived from the mechanics of the flow of ideal gases through a porous solid. Within the mathematical formulation, two diffusion mechanisms are possible: (1) the relative diffusion of one species with respect to the mixture, which is concentration gradient driven and (2) the diffusion associated with the average velocity of the gas mixture, which is total gas pressure gradient driven. The result of the theoretical formulation is a set of two coupled nonlinear differential equations written in terms of the oxidant and oxide partial pressures. The differential equations must be solved simultaneously to obtain the partial vapor pressures of the oxidant and oxides as a function of space and time. The local rate of carbon oxidation is determined as a function of space and time using the map of the local oxidant partial vapor pressure along with the Arrhenius rate equation. The nonlinear differential equations are cast into matrix equations by applying the Bubnov-Galerkin weighted residual method, allowing for the solution of the differential equations numerically. The end result is a numerical scheme capable of determining the variation of the local carbon oxidation rates as a function of space and time for any arbitrary C/SiC composite structures.
Author
Composite Structures; Silicon Carbides; Ceramic Matrix Composites; Oxidation

20030113143 NASA Glenn Research Center, Cleveland, OH, USA
Acoustic Emission and Damage Monitoring During Fatigue of C-SiC Composites at Room Temperature
Morscher, Gregory N.; Deemer, Chris; Cuneo, Jacques; Smith, Aron; Koenig, John; [2003]; 24 pp.; In English; National Space and Missile Materials Symposium, 23-27 Jun. 2003, San Diego, CA, USA
Contract(s)/Grant(s): 22-713-82-32; No Copyright; Avail: CASI; A03, Hardcopy

Fatigue experiments were performed at room temperature for C-fiber reinforced chemical vapor infiltrated (CVI Sic) matrix and melt-infiltrated (MI) matrix composites. The goal was to associate some nondestructive parameter or acoustic emission characteristic with the processes that lead to fatigue failure. Failure only occurred at loads very close to the ultimate. However, correlations between the acoustic data and the eventual failure of the composites could be made. These will be presented with respect to health monitoring of these types of composites.
Author
Fatigue (Materials); Fiber Composites; Silicon Carbides

20030113144 NASA Glenn Research Center, Cleveland, OH, USA
Mechanical Properties of Triaxial Braided Carbon/Epoxy Composites
Bowman, C. L.; Roberts, G. D.; Braley, M. S.; Xie, M.; Booker, M. J.; [2003]; 7 pp.; In English; Materials and Processing: Enabling Flight...Our Legacy and Future, 28 Sep. - 2 Oct. 2003, Dayton, OH, USA
Contract(s)/Grant(s): 22-708-24-05; Copyright; Avail: CASI; A02, Hardcopy

In an on-going effort to increase the safety and efficiency of turbine engines, the National Aeronautics and Space Administration is exploring lightweight alternatives to the metal containment structures that currently encase commercial jet engines. Epoxy reinforced with braided carbon fibers is a candidate structural material which may be suitable for an engine case. This paper reports flat-coupon mechanical-property experiments performed to compliment previously reported subcomponent impact testing and analytical simulation of containment structures. Triaxial-braid T700/5208 epoxy and triaxial-braid T700h436 toughened epoxy composites were evaluated. Also, two triaxial-braid architectures (0 degrees plus or

minus 60 degrees, and 0 degrees plus or minus 45 degrees) with the M36 resin were evaluated through tension, compression, and shear testing. Tensile behavior was compared between standard straight-sided specimens (ASTM D3039) and bow-tie specimens. Both double-notch shear (ASTM D3846) and Iosepescu (ASTM D5379) tests were performed as well. The M36/O degrees plus or minus 45 degrees configuration yield the best response when measurements were made parallel to the axial tows. Conversely, the M36/0 degrees plus or minus 60 degrees configuration was best when measurements were made perpendicular to the axial tows. The results were used to identify critical properties and to augment the analysis of impact experiments.
Author
Braided Composites; Epoxy Resins; NASA Programs

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

Includes the analysis, synthesis, and use of inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see category *34 Fluid Dynamics and Thermodynamics*. For astrochemistry see category *90 Astrophysics*.

20030112830 NASA Glenn Research Center, Cleveland, OH, USA
Nanocrystalline Chalcopyrite Materials (CuInS2 and CuInSe2) via Low-Temperature Pyrolysis of Molecular Single-Source Precursors
Castro, Stephanie L.; Bailey, Sheila G.; Raffaelle, Ryne P.; Banger, Kulbinder K.; Hepp, Aloysius F.; March 18, 2003; 22 pp.; In English
Contract(s)/Grant(s): NCC3-958; NCC3-710; NCC3-563; WBS 22-755-60-03; Copyright; Avail: CASI; A03, Hardcopy

Nanometer sized particles of the chalcopyrite compounds CuInS2 and CuInSe2 were synthesized by thermal decomposition of molecular single-source precursors (PPh3)2CuIn(SEt)4 and (PPh3)2CuIn(SePh)4, respectively, in the non-coordinating solvent dioctyl phthalate at temperatures between 200 and 300 C. The nanoparticles range in size from 3 - 30 nm and are aggregated to form roughly spherical clusters of about 500 nm in diameter. X-ray diffraction of the nanoparticle powders shows greatly broadened lines indicative of very small particle sizes, which is confirmed by TEM. Peaks present in the XRD can be indexed to reference patterns for the respective chalcopyrite compounds. Optical spectroscopy and elemental analysis by energy dispersive spectroscopy support the identification of the nanoparticles as chalcopyrites.
Author
Pyrolysis; Nanocrystals; Copper Indium Selenides; Copper Sulfides; Indium Sulfides; Low Temperature

20030112831 Case Western Reserve Univ., Cleveland, OH, USA
In-Situ Raman Spectroscopy of Single Microparticle Li-Intercalation Electrodes
Dokko, Kaoru; Shi, Qing-Fang; Stefan, Ionel C.; Scherson, Daniel A.; [2003]; 18 pp.; In English
Contract(s)/Grant(s): NAG3-2644; 22-755-12-04; No Copyright; Avail: CASI; A03, Hardcopy

Modifications in the vibrational properties of a single microparticle of LiMn2O4 induced by extraction and subsequent injection of Li(+) into the lattice have been monitored in situ via simultaneous acquisition of Raman scattering spectra and cyclic voltammetry data in 1M LiC1O4 solutions in ethylene carbonate (EC):diethyl carbonate (DEC) mixtures (1:1 by volume). Statistical analyses of the spectra in the range 15 < SOD < 45%, where SOD represents the state of discharge (in percent) of the nominally fully charged material, i.e. lambda-MnO2, were found to be consistent with the coexistence of two distinct phases of lithiated metal oxide in agreement with information derived from in situ X-ray diffraction (XRD) measurements involving more conventional battery-type electrodes.
Author
Intercalation; Microparticles; Raman Spectroscopy; Metal Ions; Lithium Compounds; In Situ Measurement; Electrodes

20030112836 Clark-Atlanta Univ., GA, USA, Massachusetts Univ., Amherst, MA, USA, NASA Glenn Research Center, Cleveland, OH, USA
Synthesis and Luminescence of Yellow/Orange-Emitting Poly[tris(2,5-dihexyloxy-l,4-phenylenevinylene)-alt-(l,3-phenylenevinylene)]s
Liao, Liang; Pang, Yi; Ding, Liming; Karasz, Frank E.; Smith, Philip R.; Meador, Michael A.; [2003]; 26 pp.; In English
Contract(s)/Grant(s): 22-706-93-05; Copyright; Avail: CASI; A03, Hardcopy

Soluble yellow/orange-emitting poly[tris(2,5-dihexyloxy-1,4-phenylenevinylene)-alt- (1,3-phenylenevinylene)]

derivatives (6) have been synthesized and characterized. These polymers contain oligo(p-phenylene vinylene) chromophores of equal conjugation length, which are linked to a m-phenylene unit. Optical comparison between 6 and its model compound 8 at room and low temperature reveals the similarity in their absorption and fluorescence band structures. The vibronic band structure of 6 is assigned with the aid of the spectroscopic data for 8 at low temperature. Polymers 6 are electroluminescent with emission lambda (sub max), at approximately 565 nm. By using the device configuration of ITO/PEDOT/6/Ca, the polymer exhibits an external EL efficiency as high as 0.46%.
Author
Luminescence; Polymers; Synthesis (Chemistry); Spectroscopy; Phenyls; Emittance

20030112839 NASA Glenn Research Center, Cleveland, OH, USA
Interactions of Water Vapor with Oxides at Elevated Temperatures
Jacobson, Nathan; Opila, Elizabeth; Copland, Evan; Myers, Dwight; [2003]; 27 pp.; In English
Contract(s)/Grant(s): 22-708-31-22; Copyright; Avail: CASI; A03, Hardcopy

Many volatile metal hydroxides form by reaction of the corresponding metal oxide with water vapor. These reactions are important in a number of high temperature corrosion processes. Experimental methods for studying the thermodynamics of metal hydroxides include: gas leak Knudsen cell mass spectrometry, free jet sampling mass spectrometry, transpiration and hydrogen-oxygen flame studies. The available experimental information is reviewed and the most stable metal hydroxide species are correlated with position in the periodic table. Current studies in our laboratory on the Si-O-H system are discussed.
Author
High Temperature; Oxides; Water Vapor; Chemical Reactions; Thermodynamics

20030112850 NASA Glenn Research Center, Cleveland, OH, USA, Missouri Univ., Rolla, MO, USA
In General, the Total Voltammetric Current from a Mixture of Redox-Active Substances will Not be the Sum of the Currents that Each Substance would Produce Independently at the Same Concentration as in the Mixture
Leventis, Nicholas; Oh, Woon Su; Gao, Xue-Rong; Rawashdeh, Abdel Monem M.; April 23, 2003; 35 pp.; In English
Contract(s)/Grant(s): ACS-35154-AC5; 22-279-00-03-02; Copyright; Avail: CASI; A03, Hardcopy

At the potential range where both decamethylferrocene (dMeFc) and ferrocene (Fc) are oxidized with rates controlled by linear diffusion, electrogenerated Fc(+) radicals diffusing outwards from the electrode react quantitatively (K23 C=5.8 x 10(exp 8) with dMeFc diffusing towards the electrode and produce Fc and dMeFc. That reaction replaces dMeFc with Fc, whose diffusion coefficient is higher than that of dMeFc(+), and the total mass-transfer limited current from the mixture is increased by approximately 10%. Analogous observations are made when mass-transfer is controlled by convective-diffusion as in RDE voltammetry. Similar results have been obtained with another, and for all practical purposes randomly selected pair of redox-active substances, [Co(bipy)3](2+) and N - methylphenothiazine (MePTZ); reaction of MePTZ(+) with [Co(bipy)3](2+) replaces the latter with MePTZ, which diffuses faster and the current increases by approximately 20%. The experimental voltammograms have been simulated numerically and the role of (a) the rate constant of the homogeneous reaction; (b) the relative concentrations; and, (c) the diffusion coefficients of all species involved have been studied in detail. Importantly, it was also identified that within any given redox system the dependence of the mass-transfer limited current on the bulk concentrations of the redox-active species is expected to be non-linear. These findings are discussed in terms of their electroanalytical implications.
Author
Oxidation-Reduction Reactions; Electrochemistry; Electric Current; Mixtures; Concentration (Composition)

20030112925 Nevada Univ., Las Vegas, NV, USA
Molecular Beam Epitaxy of Nitrides: Theoretical Modeling and Process Simulation
Venkat, Rama; Mar. 2003; 74 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0188; Proj-3484
Report No.(s): AD-A418076; AFRL-SR-AR-TR-03-0376; No Copyright; Avail: CASI; A04, Hardcopy

A rate equation approach is proposed based on physically sound surface processes to investigate the molecular beam epitaxy growth and doping of 111-N using ammonia and ECR plasma source. A surface riding layer of Ga/In/Mg and ammonia or N plasma species are included in the model. The surface riding species are allowed to undergo several physical and chemical processes. In the case of ammonia, the simulated Ga incorporation rate as a function of ammonia pressure and substrate temperature are in excellent agreement with the experimental data. Ga incorporation increases with increasing ammonia overpressure. Simulated Ga desorption parameter versus time data is also in good qualitative agreement with the

experimental data. In the case of ECR plasma, electron concentration obtained from bulk vacancy concentrations of Ga and N decreases linearly with ECR power unlike the experimental observation of exponential decrease. In InGaN growth, results of In incorporation obtained from simulations and experiments are in excellent agreement for various growth conditions. In segregation is found to be negligible below 580 deg C. Above 640 deg C, the segregation dominates the kinetics. This temperature dependence is found to be independent of the fluxes. In MgGaN growth, simulations were carried for various growth temperatures in the range of 600-750 deg C. with constant flux rates of Mg, Ga and N. For the given flux rates, it is found that Mg segregates the surface with the increase in temperature. Above 750 deg C a dopant depleted zone is formed below the surface layer. Results obtained from simulations are in excellent agreement with the experimental data.
DTIC
Nitrides; Molecular Beam Epitaxy; Electron Cyclotron Resonance; Gallium Nitrides; Indium Compounds

26
METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

20030113008 Missouri Univ., Rolla, MO, USA
High Resolution, Single-Step Patterning of Silica Aerogels
Bertino, M. F.; Hund, J. F.; Sosa, J.; Zhang, G.; Sotiriou-Leventis, C.; Leventis, N.; Tokuhiro, A. T.; Terry, J.; [2003]; 10 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

Three-dimensional metallic structures are fabricated with high spatial resolution in silica aerogels. In our method, silica hydrogels are prepared with a standard base-catalyzed route, and exchanged with an aqueous solution typically containing Ag' ions (1 M) and 2-propanol (0.2 M). The metal ions are reduced photolytically with a table-top ultraviolet lamp, or radiolytically, with a focused X-ray beam. We fabricated dots and lines as small as 30 x 70 km, protruding for several mm into the bulk of the materials. The hydrogels are eventually supercritically dried to yield aerogels, without any measurable change in the shape and spatial resolution of the lithographed structures. Transmission electron microscopy shows that illuminated regions are composed of Ag clusters with a size of several pm, separated by thin layers of silica.
Author
Aerogels; Fabrication

28
PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

20030112865 NASA Glenn Research Center, Cleveland, OH, USA
Reduced Equations for Calculating the Combustion Rates of Jet-A and Methane Fuel
Molnar, Melissa; Marek, C. John; November 2003; 65 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WBS 22-708-87-16
Report No.(s): NASA/TM-2003-212702; E-14205; NAS 1.15:212702; No Copyright; Avail: CASI; A04, Hardcopy

Simplified kinetic schemes for Jet-A and methane fuels were developed to be used in numerical combustion codes, such as the National Combustor Code (NCC) that is being developed at Glenn. These kinetic schemes presented here result in a correlation that gives the chemical kinetic time as a function of initial overall cell fuel/air ratio, pressure, and temperature. The correlations would then be used with the turbulent mixing times to determine the limiting properties and progress of the reaction. A similar correlation was also developed using data from NASA's Chemical Equilibrium Applications (CEA) code to determine the equilibrium concentration of carbon monoxide as a function of fuel air ratio, pressure, and temperature. The NASA Glenn GLSENS kinetics code calculates the reaction rates and rate constants for each species in a kinetic scheme for finite kinetic rates. These reaction rates and the values obtained from the equilibrium correlations were then used to calculate the necessary chemical kinetic times. Chemical kinetic time equations for fuel, carbon monoxide, and NOx were obtained for both Jet-A fuel and methane.
Author
Combustion Chemistry; Kinetic Equations; Jet Engine Fuels; Methane

29
SPACE PROCESSING

Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced-gravity environments. For legal aspects of space commercialization see *84 Law, Political Science and Space Policy*.

20030112858 Princeton Univ., NJ, USA
Report on the NASA Soft and Complex Condensed Matter Workshop
Singh, Bhim, Technical Monitor; Chaikin, Paul; Nagel, Sidney; November 2003; 28 pp.; In English; Soft and Complex Condensed Matter Workshop, 6 Mar 2003, Austin, TX, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG3-2248; WBS 22-101-53-01
Report No.(s): NASA/CR-2003-212618; E-14164; NAS 1.26:212618; No Copyright; Avail: CASI; A03, Hardcopy

During the past decade, NASA has been a leading U.S. supporter of soft and complex condensed matter research. Experiments in space shuttles, MIR, the International Space Station (ISS), as well as ground-based research have provided new insights into several areas including hard sphere colloids, crystal growth, phase ordering, and transport of complex fluids at the critical point. To help define the next generation of flight experiments needed to answer remaining important questions in the field of soft and complex condensed matter, NASA's Office of Biological and Physical Science sponsored a workshop on Soft and Complex Condensed Matter, March 6, 2003. This workshop asked leading members in the field of Soft and Complex Condensed Matter (at the APS March Meeting) to help identify exciting unanswered questions in the field, along with specific research topics for which the absence of gravity would enable significant results unobtainable by other means. The workshop was attended by 24 participants from universities across the U.S. and from five different countries (in addition to NASA GRC participants).
Author
Condensed Matter Physics; Space Processing; Conferences; Low Gravity Manufacturing

31
ENGINEERING (GENERAL)

Includes general research topics related to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.

20030112976 Naval Postgraduate School, Monterey, CA
Maximizing the Stability of an Ensemble of Clocks
Ruiz, Juan J.; Sep. 2003; 103 pp.; In English; Original contains color illustrations
Report No.(s): AD-A418283; No Copyright; Avail: CASI; A06, Hardcopy

Atomic Clocks provide 'stable' signals that are mainly used to generate time scales and to measure differences of time between events. Each atomic clock can individually be characterized according to the stability of the scale it produces. Due to the stochastic behavior of each clock, usually clock ensembles are used to build more stable time scales. This process requires basically two steps. First it is required to individually characterize each time source to identify the particular noise components present. Second, a measure of performance is required in order to derive an algorithm based on it to properly 'weigh' this particular clock in the process of creating a combined scale. In this thesis both problems are faced using an operations research approach: each clock is modeled, analyzed and characterized by a time-dependent measure of performance related to its intrinsic stability, and optimally combined to produce a more stable combined time scale. The optimality criterion is directly related to the spectral characteristics of the noise sources present.
DTIC
Atomic Clocks; Operations Research; Optimization

33
ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment; and microelectronics and integrated circuitry. for related information see also *60 Computer Operations and Hardware*; and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar*.

20030112829 Air Force Research Lab., Hanscom AFB, MA, USA

The Significance of Genetic Representation in Genetic Antenna Design

ODonnell, Terry H.; Altshuler, Edward E.; Best, Steven R.; Jan. 2003; 4 pp.; In English

Report No.(s): AD-A418160; No Copyright; Avail: CASI; A01, Hardcopy

Genetic algorithms have been shown to be effective in the design of small antennas. However, their effectiveness depends on both the mechanisms of the genetic algorithm and the genetic representation of the problem. Here we present three genetic chromosome representations for a small antenna design problem (lowest VSWR for a specified h/lambda cube size) and compare the results of the three optimization processes. Our work shows that different chromosome representations lead to solutions in different, overlapping subclasses, and that an important consideration in genetic antenna design is finding a simple chromosome representation which is capable of representing the subclass containing the 'optimal' solution. Our initial results show that the chromosome design itself is an important factor in successful genetic antenna design.

DTIC

Monopole Antennas; Genetic Algorithms; Antenna Design; Chromosomes

20030112853 NASA Glenn Research Center, Cleveland, OH, USA

Phased Array Antenna Testbed Development at the NASA Glenn Research Center

Lambert, Kevin M.; Kubat, Gregory; Johnson, Sandra K.; Anzic, Godfrey; November 2003; 11 pp.; In English; 25th Annual Meeting and Symposium, 19-24 Oct. 2003, Irvine, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 22-322-20-04

Report No.(s): NASA/TM-2003-212602; E-14160; Copyright; Avail: CASI; A03, Hardcopy

Ideal phased array antennas offer advantages for communication systems, such as wide-angle scanning and multibeam operation, which can be utilized in certain NASA applications. However, physically realizable, electronically steered, phased array antennas introduce additional system performance parameters, which must be included in the evaluation of the system. The NASA Glenn Research Center (GRC) is currently conducting research to identify these parameters and to develop the tools necessary to measure them. One of these tools is a testbed where phased array antennas may be operated in an environment that simulates their use. This paper describes the development of the testbed and its use in characterizing a particular K-Band, phased array antenna.

Author

Phased Arrays; Antenna Arrays; Research Facilities

20030112905 Universal Display Corp., Ewing, NJ, USA

Ruggedized Full-Color Flexible OLED Display

Hack, Michael; Forrest, Stephen R.; Thompson, Mark; Jackson, Tom; Praino, Robert; Jun. 2003; 70 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MDA972-00-C-0017; Proj-H731

Report No.(s): AD-A418358; AFRL-HE-WP-TR-2003-0092; No Copyright; Avail: CASI; A04, Hardcopy

The objective of this program was to demonstrate a flexible, rugged, bright and efficient phosphorescent OLED technology with a low cost manufacturing path. The team comprised Universal Display Corporation, Princeton University, the University of Southern California, Penn State University, L3 Displays and Vitex Systems, and was led by Universal Display Corporation (PI: Michael Hack). The program focused on developing the technology to enable reliable low power consumption flexible (FOLED(Trademark)) displays to be fabricated on plastic substrates. This involved the integration of phosphorescent OLEDs (PHOLED(Trademark)) with multi-layer permeation barriers deposited over the substrate and also as a thin film encapsulant over the OLED to prevent degradation by oxygen or moisture. Additional tasks were development of large area, low cost organic vapor phase deposition (OVPD(Trademark)) fabrication technology, along with novel approaches to demonstrating bistable OLED pixels for advanced displays with reduced information bandwidth requirements. Accomplishments included the demonstration of thin film encapsulated OLED pixels on plastic substrates with lifetimes exceeding 2,000 hours, the delivery to the government of monochrome, phosphorescent OLED passive-matrix displays on plastic substrates, high performance OLEDs and TFTs grown using OVPD, and bistable OLED pixels fabricated from both

a novel integrated organic OLED (TOLED(Trademark)) integrated with an organic photodetector, as well as a second approach utilizing OLEDs and amorphous silicon TFTs.
DTIC
Light Emitting Diodes; Organic Materials; Fabrication; Ruggedness; Flexibility

20030112913 Pennsylvania State Univ., University Park, PA
Water Tunnel Downstream Array (ARL No. 02-16) Design and Test Report
Allen, C. W.; Myer, E. C.; Kline, B. L.; Oct. 27, 2003; 42 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-01-1-0311
Report No.(s): AD-A418375; No Copyright; Avail: CASI; A03, Hardcopy

A four-ring, broadband receiver array was designed, fabricated, and tested by the Applied Research Laboratory at Pennsylvania State University to replace the existing downstream array in the large diameter water tunnel. The new array (ARL no. 02-16) provides a substantially larger frequency-operating band (0.5 to 200 kHz) than the previous array. The array is fabricated from 1-3 composite materials and has four separate ring channels and a sum (all four rings) channel, which, along with the preamplifier, incorporates amplitude shading to provide low sidelobe levels (typically less than -30 dB). The array and preamplifier exhibit low noise levels that are less than 20 dB re: micron Pa/ Hz(sup 1/2) for the sum channel over the majority of the operating band. This material is based upon work supported by the Office of Naval Research through the Naval Sea Systems Command under Grant No. N00014-01-1-0311, Instrumentation and Equipment Upgrades to Improve Acoustical and Fluid Dynamic Measurements in the Garfield Thomas Water Tunnel.
DTIC
Receivers; Water Tunnel Tests; Antenna Arrays; Underwater Acoustics

20030113027 BAE Systems, Nashua, NH, USA
Progress in GaAs Metamorphic HEMT Technology for Microwave Applications. High Efficiency Ka-Band MHEMT Power MMICs
Smith, P. M.; Dugas, D.; Chu, K.; Nichols, K.; Duh, K. H.; Fisher, J.; MtPleasant, L.; Xu, D.; Gunter, L.; Vera, A., et al.; [2003]; 4 pp.; In English; IEEE GaAs IC Symposium, 10 Nov. 2003, San Diego, CA, USA
Contract(s)/Grant(s): NAS3-01090; DAAD19-01-C-0068; Copyright; Avail: CASI; A01, Hardcopy

This paper reviews recent progress in the development of GaAs metamorphic HEMT (MHEMT) technology for microwave applications. Commercialization has begun, while efforts to further improve performance, manufacturability and reliability continue. We also report the first multi-watt MHEMT MMIC power amplifiers, demonstrating up to 3.2W output power and record power-added efficiency (PAE) at Ka-band.
Author
Gallium Arsenides; High Electron Mobility Transistors

20030113048 NASA Glenn Research Center, Cleveland, OH, USA
Monolithic Interconnected Modules (MIMs) for Thermophotovoltaic Energy Conversion
Wilt, David; Wehrer, Rebecca; Palmisiano, Marc; Wanlass, Mark; Murray, Christopher; [2003]; 20 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Monolithic Interconnected Modules (MIM) are under development for thermophotovoltaic (TPV) energy conversion applications. MIM devices are typified by series-interconnected photovoltaic cells on a common, semi-insulating substrate and generally include rear-surface infrared (IR) reflectors. The MIM architecture is being implemented in InGaAsSb materials without semi-insulating substrates through the development of alternative isolation methodologies. Motivations for developing the MIM structure include: reduced resistive losses, higher output power density than for systems utilizing front surface spectral control, improved thermal coupling and ultimately higher system efficiency. Numerous design and material changes have been investigated since the introduction of the MIM concept in 1994. These developments as well as the current design strategies are addressed.
Author
Energy Conversion; Modules; Thermophotovoltaic Conversion; Integrated Circuits; Fabrication

20030113132 Case Western Reserve Univ., Cleveland, OH, USA
In-Situ, Time-Resolved Raman Spectro-micro-topography of an Operating Lithium Ion Battery
Luo, Yu; Cai, Wen-Bin; Xing, Xue-Kun; Scherson, Daniel A.; March 2003; 19 pp.; In English
Contract(s)/Grant(s): NAG3-2644; 22-755-12-04; No Copyright; Avail: CASI; A03, Hardcopy

A Raman microscope has been coupled to a computer-controlled, two-dimensional linear translator attached to a custom-designed, sealed optical chamber to allow in situ acquisition of space-, and time-resolved spectra of an operating thin graphite/LiCoO2 Li-ion battery. This unique arrangement made it possible to collect continuously series of Raman spectra from a sharply defined edge of the battery exposing the anode (A), separator (S), and cathode (C), during charge and discharge, while the device was moved back and forth under the fixed focused laser beam along an axis normal to the layered A/S/C plane. Clear spectral evidence was obtained for changes in the amount of Li(+) within particles of graphite in the anode, and, to a lesser extent, of LiCoO2 in the cathode, during battery discharge both as a function of position and time. Analysis of time-resolved Raman spectro-micro-topography (SMT) measurements of the type described in this work are expected to open new prospects for assessing the validity of theoretical models aimed at simulating the flow of Li(+) within Li-ion batteries under operating conditions.
Author
Topography; Raman Spectra; Time Functions; Lithium Batteries; Electric Batteries

34
FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics*.

20030112833 NASA Glenn Research Center, Cleveland, OH, USA
Investigation of the Flow Physics Driving Stall-Side Flutter in Advanced Forward Swept Fan Designs
Sanders, Albert J.; Liu, Jong S.; Panovsky, Josef; Bakhle, Milind A.; Stefko, George; Srivastava, Rakesh; [2003]; 7 pp.; In English; Tenth International Symposium on Unsteady Aerodynamics, Aeroacoustics and Aeroelasticity of Turbornachines (10th ISUAAAT), 7-11 Sep. 2003, Durham, NC, USA; Copyright; Avail: CASI; A02, Hardcopy

Flutter-free operation of advanced transonic fan designs continues to be a challenging task for the designers of aircraft engines. In order to meet the demands of increased performance and lighter weight, these modern fan designs usually feature low-aspect ratio shroudless rotor blade designs that make the task of achieving adequate flutter margin even more challenging for the aeroelastician. This is especially true for advanced forward swept designs that encompass an entirely new design space compared to previous experience. Fortunately, advances in unsteady computational fluid dynamic (CFD) techniques over the past decade now provide an analysis capability that can be used to quantitatively assess the aeroelastic characteristics of these next generation fans during the design cycle. For aeroelastic applications, Mississippi State University and NASA Glenn Research Center have developed the CFD code TURBO-AE. This code is a time-accurate three-dimensional Euler/Navier-Stokes unsteady flow solver developed for axial-flow turbomachinery that can model multiple blade rows undergoing harmonic oscillations with arbitrary interblade phase angles, i.e., nodal diameter patterns. Details of the code can be found in Chen et al. (1993, 1994), Bakhle et al. (1997, 1998), and Srivastava et al. (1999). To assess aeroelastic stability, the work-per-cycle from TURBO-AE is converted to the critical damping ratio since this value is more physically meaningful, with both the unsteady normal pressure and viscous shear forces included in the work-per-cycle calculation. If the total damping (aerodynamic plus mechanical) is negative, then the blade is unstable since it extracts energy from the flow field over the vibration cycle. TURBO-AE is an integral part of an aeroelastic design system being developed at Honeywell Engines, Systems & Services for flutter and forced response predictions, with test cases from development rig and engine tests being used to validate its predictive capability. A recent experimental program (Sanders et al., 2002) was aimed at providing the necessary unsteady aerodynamic and vibratory response data needed to validate TURBO-AE for fan flutter predictions. A comparison of numerical TURBO-AE simulations with the benchmark flutter data is given in Sanders et al. (2003), with the data used to guide the validation of the code and define best practices for performing accurate unsteady simulations. The agreement between the analyses and the predictions was quite remarkable, demonstrating the ability of the analysis to accurately model the unsteady flow processes driving stall-side flutter.
Derived from text
Computational Fluid Dynamics; Flutter; Turbomachinery; Unsteady Aerodynamics; Fans; Engine Design; Flow Distribution

20030112843 NASA Glenn Research Center, Cleveland, OH, USA
Thermodynamic Modeling of the YO(l.5)-ZrO2 System
Jacobson, Nathan S.; Liu, Zi-Kui; Kaufman, Larry; Zhang, Fan; [2003]; 30 pp.; In English; HTMC-XI, 18-24 May 2003, Tokyo, Japan
Contract(s)/Grant(s): 22-708-31-22; Copyright; Avail: CASI; A03, Hardcopy

The YO1.5-ZrO2 system consists of five solid solutions, one liquid solution, and one intermediate compound. A thermodynamic description of this system is developed, which allows calculation of the phase diagram and thermodynamic properties. Two different solution models are used-a neutral species model with YO1.5 and ZrO2 as the components and a charged species model with Y(+3), Zr(+4), O(-2), and vacancies as components. For each model, regular and sub-regular solution parameters are derived fiom selected equilibrium phase and thermodynamic data.
Author
Thermodynamics; Zirconium Oxides; Yttrium Oxides; Mathematical Models

20030112851 NASA Glenn Research Center, Cleveland, OH, USA
Mean Flow Boundary Conditions for Computational Aeroacoustics
Hixon, R.; Nallasamy, M.; Sawyer, S.; Dyson, R.; [2003]; 8 pp.; In English; 9th AIAA/CEAS Aeroacoustics Conference, 1 May 2003, Hilton Head, SC, USA
Report No.(s): AIAA Paper 2003-3299; Copyright; Avail: CASI; A02, Hardcopy

In this work, a new type of boundary condition for time-accurate Computational Aeroacoustics solvers is described. This boundary condition is designed to complement the existing nonreflective boundary conditions while ensuring that the correct mean flow conditions are maintained throughout the flow calculation. Results are shown for a loaded 2D cascade, started with various initial conditions.
Author
Aeroacoustics; Boundary Conditions; Flow Distribution; Unsteady Flow

20030112963 Naval Postgraduate School, Monterey, CA
Performance and Flow Regimes in Plane 2-D Diffusers With Exit Channels at Low Reynolds Numbers
Trivilos, Epameinondas; Sep. 2003; 99 pp.; In English; Original contains color illustrations
Report No.(s): AD-A418272; No Copyright; Avail: CASI; A05, Hardcopy

A numerical study on laminar incompressible flows in 2-D straight walled diffusers in the low Reynolds number regime (105-1048) is presented to investigate performance and various flow regimes that might exist. Tail channels are situated downstream the diffusers. Geometries with area ratios AR-=1.15 to 5 and non-dimensional lengths of L/W1=1 to 48 are considered. Results are presented in terms of flow regime maps for Reynolds numbers of 105, 210, 314, 420, 629, 1,048 and pressure recovery coefficients maps for Re numbers of 105, 210, 314, 420 and 629. In addition time resolved simulations of impulsively starting flow are considered at Re=210, 314 for 12 geometries on the flow regime map. Four flow regimes can be distinguished depending on diffuser geometry. With increasing divergence angle the flow goes from attached to symmetrically separated to asymmetrically separated and finally to a non 2-D pattern respectively.
DTIC
Incompressible Flow; Laminar Flow; Two Dimensional Flow; Numerical Analysis; Low Reynolds Number

20030112990 NASA Marshall Space Flight Center, Huntsville, AL, USA
Using CFD as Rocket Injector Design Tool: Recent Progress at Marshall Space Flight Center
Tucker, Kevin; West, Jeff; Williams, Robert; Lin, Jeff; Rocker, Marvin; Canabal, Francisco; Robles, Bryan; Garcia, Robert; Chenoweth, James; [2003]; 43 pp.; In English; 5th International Symposium on Liquid Space Propulsion Long Life Combustion Devices Technology, 27-30 Oct. 2003, Chatanooga, TN, USA; Copyright; Avail: CASI; A03, Hardcopy

The choice of tools used for injector design is in a transitional phase between exclusive reliance on the empirically based correlations and extensive use of computational fluid dynamics (CFD). The Next Generation Launch Technology (NGLT) Program goals emphasizing lower costs and increased reliability have produced a need to enable CFD as an injector design tool in a shorter time frame. This is the primary objective of the Staged Combustor Injector Technology Task currently under way at Marshall Space Flight Center (MSFC). The documentation of this effort begins with a very brief status of current injector design tools. MSFC's vision for use of CFD as a tool for combustion devices design is stated and discussed with emphasis on the injector. The concept of the Simulation Readiness Level (SRL), comprised of solution fidelity, robustness and accuracy, is introduced and discussed. This quantitative measurement is used to establish the gap between the current state of demonstrated capability and that necessary for regular use in the design process. MSFC's view of the validation process is presented and issues associated with obtaining the necessary data are noted and discussed. Three current experimental efforts aimed at generating validation data are presented. The importance of uncertainty analysis to understand the data quality is also demonstrated. First, a brief status of current injector design tools is provided as context for the current effort. Next, the MSFC vision for using CFD as an injector design tool is stated. A generic CFD-based injector design methodology is also outlined

and briefly discussed. Three areas where MSFC is using injector CFD analyses for program support will be discussed. These include the Integrated Powerhead Development (IPD) engine which uses hydrogen and oxygen propellants in a full flow staged combustion (FFSC) cycle and the TR-107 and the RS84 engine both of which use RP-1 and oxygen in an ORSC cycle. Finally, an attempt is made to objectively summarize what progress has been made at MSFC in enabling CFD as an injector design tool.
Author
Computational Fluid Dynamics; Rocket Engine Design; Research Facilities; Injectors

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INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Avionics and Aircraft Instrumentation*; and *19 Spacecraft Instrumentation and Astrionics*.

20030112952 Arkansas Univ., Fayetteville, AR, USA
Resonant Spectra of Malignant Breast Cancer Tumors Using the Three-Dimensional Electromagnetic Fast Multipole Model, Part 1
El-Shenawee, Magda; [2003]; 55 pp.; In English
Contract(s)/Grant(s): NAG1-020; NSF EEC-99-86821; No Copyright; Avail: CASI; A04, Hardcopy

An intensive numerical study for the resonance scattering of malignant breast cancer tumors is presented. The rigorous three-dimensional electromagnetic model, based on the equivalence theorem, is used to obtain the induced electric and magnetic currents on the breast and tumor surfaces. The results show that a non-spherical malignant tumor can be characterized based its spectra regardless of its orientation, the incident polarization, or the incident or scattered directions. The tumor's spectra depend solely on its physical characteristics (i.e., the shape and the electrical properties), however, their locations are not functions of its burial depth. This work provides a useful guidance to select the appropriate frequency range for the tumor's size.
Author
Mammary Glands; Cancer; Imaging Techniques; Magnetic Spectroscopy; Magnetic Resonance

20030112958 Science Applications International Corp., USA
Assimilation of Satellite Ozone Observations
Stajner, I.; Winslow, N.; Wargan, K.; Hayashi, H.; Pawson, S.; Rood, R.; [2003]; 1 pp.; In English; EGS-AGU-EUG Joint Assembly, 6-11 Apr. 2003, Nice, France; No Copyright; Avail: Other Sources; Abstract Only

This talk will discuss assimilation of ozone data from satellite-borne instruments. Satellite observations of ozone total columns and profiles have been measured by a series of Total Ozone Mapping Spectrometer (TOMS), Solar Backscatter Ultraviolet (SBUV) instruments, and more recently by the Global Ozone Monitoring Experiment. Additional profile data are provided by instruments on NASA's Upper Atmosphere Research Satellite and by occultation instruments on other platforms. Instruments on Envisat' and future EOS Aura satellite will supply even more comprehensive data about the ozone distribution. Satellite data contain a wealth of information, but they do not provide synoptic global maps of ozone fields. These maps can be obtained through assimilation of satellite data into global chemistry and transport models. In the ozone system at NASA's Data Assimilation Office (DAO) any combination of TOMS, SBUV, and Microwave Limb sounder (MLS) data can be assimilated. We found that the addition of MLS to SBUV and TOMS data in the system helps to constrain the ozone distribution, especially in the polar night region and in the tropics. The assimilated ozone distribution in the troposphere and lower stratosphere is sensitive also to finer changes in the SBUV and TOMS data selection and to changes in error covariance models. All results are established by comparisons of assimilated ozone with independent profiles from ozone sondes and occultation instruments.
Author
Ozone; Satellite-Borne Instruments; Satellite Observation; Data Acquisition

20030112977 NASA Goddard Space Flight Center, Greenbelt, MD, USA
GOME Total Ozone and Calibration Error Derived Usign Version 8 TOMS Algorithm
Gleason, J.; Wellemeyer, C.; Qin, W.; Ahn, C.; Gopalan, A.; Bhartia, P.; [2003]; 1 pp.; In English; EGS-AGU-EUG Joint Assembly 2003, 7-11 Apr. 2003, Nice, France; No Copyright; Avail: Other Sources; Abstract Only

The Global Ozone Monitoring Experiment (GOME) is a hyper-spectral satellite instrument measuring the ultraviolet backscatter at relatively high spectral resolution. GOME radiances have been slit averaged to emulate measurements of the Total Ozone Mapping Spectrometer (TOMS) made at discrete wavelengths and processed using the new TOMS Version 8 Ozone Algorithm. Compared to Differential Optical Absorption Spectroscopy (DOAS) techniques based on local structure in the Huggins Bands, the TOMS uses differential absorption between a pair of wavelengths including the local stiucture as well as the background continuum. This makes the TOMS Algorithm more sensitive to ozone, but it also makes the algorithm more sensitive to instrument calibration errors. While calibration adjustments are not needed for the fitting techniques like the DOAS employed in GOME algorithms, some adjustment is necessary when applying the TOMS Algorithm to GOME. Using spectral discrimination at near ultraviolet wavelength channels unabsorbed by ozone, the GOME wavelength dependent calibration drift is estimated and then checked using pair justification. In addition, the day one calibration offset is estimated based on the residuals of the Version 8 TOMS Algorithm. The estimated drift in the 2b detector of GOME is small through the first four years and then increases rapidly to +5% in normalized radiance at 331 nm relative to 385 nm by mid 2000. The lb detector appears to be quite well behaved throughout this time period.
Author
Algorithms; Calibrating; Instrument Errors; Total Ozone Mapping Spectrometer; Satellite Instruments

20030112989 NASA Goddard Space Flight Center, Greenbelt, MD, USA
New Total Ozone Algorithm for Application to the Total Ozone Mapping Spectrometer
Wellemeyer, C.; Bhartia, P. K.; Taylor, S. L.; Qin, W.; Flynn, L.; Seftor, C.; [2003]; 1 pp.; In English; EGS-AGU-EUG Joint Assembly 2003, 7-11 Apr. 2003, Nice, France; No Copyright; Avail: Other Sources; Abstract Only

The Total Ozone Mapping Spectrometer (TOMS) series comprises four instruments providing a total of 25 years of daily global stratospheric ozone data over the sunlit portion of the Earth. A new retrieval algorithm has been developed for TOMS, designated Version 8. The algorithm is based on differential absorption across a pair of wavelength channels chosen close together to minimize the impact of wavelength dependent forward modeling errors. Version 8 enhancements include correction for the presence of tropospheric aerosols and sun glint from water surfaces, a better treatment of variability due to tropospheric ozone and temperature dependence, and an improved forward model, particularly in regions of persistent snow and ice. Among other things, the Version 8 enhancements have reduced latitudinal dependence seen previously in TOMS - Dobson comparisons, predominantly in the Southern Hemisphere's summer, when the tropospheric ozone, temperature, and snow/ice corrections are additive. The basic components of the algorithm and its impact on derived total ozone will be discussed.
Author
Algorithms; Total Ozone Mapping Spectrometer; Satellite Instruments

20030113040 NASA Goddard Space Flight Center, Greenbelt, MD, USA
EOS-Aura's Ozone Monitoring Instrument (OMI): Validation Requirements
Brinksma, E. J.; McPeters, R.; deHaan, J. F.; Levelt, P. F.; Hilsenrath, E.; Bhartia, P. K.; [2003]; 1 pp.; In English; EGS-AGU-EUG Joint Assembly 2003, 7-11 Apr. 2003, Nice, France; Copyright; Avail: Other Sources; Abstract Only

OMI is an advanced hyperspectral instrument that measures backscattered radiation in the UV and visible. It will be flown as part of the EOS Aura mission and provide data on atmospheric chemistry that is highly synergistic with other Aura instruments HIRDLS, MLS, and TES. OMI is designed to measure total ozone, aerosols, cloud information, and UV irradiances, continuing the TOMS series of global mapped products but with higher spatial resolution. In addition its hyperspectral capability enables measurements of trace gases such as SO2, NO2, HCHO, BrO, and OClO. A plan for validation of the various OM1 products is now being formulated. Validation of the total column and UVB products will rely heavily on existing networks of instruments, like NDSC. NASA and its European partners are planning aircraft missions for the validation of Aura instruments. New instruments and techniques (DOAS systems for example) will need to be developed, both ground and aircraft based. Lidar systems are needed for validation of the vertical distributions of ozone, aerosols, NO2 and possibly SO2. The validation emphasis will be on the retrieval of these products under polluted conditions. This is challenging because they often depend on the tropospheric profiles of the product in question, and because of large spatial variations in the troposphere. Most existing ground stations are located in, and equipped for, pristine environments. This is also true for almost all NDSC stations. OMI validation will need ground based sites in polluted environments and specially developed instruments, complementing the existing instrumentation.
Author
Ozone; Backscattering; Spacecraft Instruments; Earth Observing System (Eos)

20030113054 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Optomechanical Alignment of the Grating Wheel Mechanism for a Ground-based, Cryogenic, Near-Infrared Astronomy Instrument

Gutkowski, Sharon M.; Ohl, Raymond G.; Hagopian, John G.; Kraft, Stephen E.; Mentzell, J. Eric; Schepis, Joseph P.; Sparr, Leroy M.; Greenhouse, Matthew A.; Hyland, Jason; Mackenty, John W.; [2003]; 1 pp.; In English; SPIE-Optical Science and Technology Annual Meeting, 3-8 Aug. 2003, San Diego, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

We describe the population, optomechanical alignment, and alignment verification of near-infrared gratings on the grating wheel mechanism (GWM) for the Infrared Multi- Object Spectrometer (IRMOS). IRMOS is a cryogenic (80 K) facility instrument for the Mayall Telescope (3.8 m) at Kitt Peak National Observatory and a MEMS spectrometer concept demonstrator for NASA's James Webb Space Telescope. The IRMOS optics, bench, and mechanisms are predominantly made of Al 6061 -T651. The GWM consists of 13 planar diffraction gratings and one flat imaging mirror (58 x 57 mm), each mounted at a unique compound angle on a 31.8 cm diameter gear. The Al 6061 grating substrates are stress relieved for enhanced cryogenic performance and the optical surface is replicated from an off-the-shelf master. The imaging mirror is diamond turned and post-polished. The grating mechanism spans a projected diameter of approximately 48cm when fully assembled, utilizes several flexure designs throughout the system to accommodate thermal gradient situations, and is controlled using custom software with an off-the-shelf controller. Each optic is aligned in six degrees of freedom relative to the GWM coordinate system, which is defined relative to an optical alignment cube mounted at the center of the gear. The tip/tilt (Rx, Ry) orientation of a given grating is measured using the zero-order return from an autocollimating theodolite. Each optic's mount includes a one-piece shim located between the optic and the gear. The shim is machined to fine align each optic. We also describe alignment verification, where grating diffractive properties are compared to model predictions.

Author

Cryogenics; Near Infrared Radiation; Infrared Astronomy; Alignment; Spacecraft Instruments

20030113055 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Ambient and Cryogenic Alignment Verification and Performance of the Infrared Multi-Object Spectrometer

Connelly, Joseph A.; Ohl, Raymond G.; Mink, Ronald G.; Mentzell, J. Eric; Saha, Timo T.; Tveekrem, June L.; Hylan, Jason E.; Sparr, Leroy M.; Chambers, V. John; Hagopian, John G., et al.; [2003]; 1 pp.; In English; SPIE-Optical Science and Technology Annual Meeting, 3-8 Aug. 2003, San Diego, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The Infrared Multi-Object Spectrometer (IRMOS) is a facility instrument for the Kitt Peak National Observatory 4 and 2.1 meter telescopes. IRMOS is a near-IR (0.8 - 2.5 micron) spectrometer with low- to mid-resolving power (R = 300 - 3000). IRMOS produces simultaneous spectra of approximately 100 objects in its 2.8 x 2.0 arc-min field of view using a commercial Micro Electro-Mechanical Systems (MEMS) Digital Micro-mirror Device (DMD) from Texas Instruments. The IRMOS optical design consists of two imaging subsystems. The focal reducer images the focal plane of the telescope onto the DMD field stop, and the spectrograph images the DMD onto the detector. We describe ambient breadboard subsystem alignment and imaging performance of each stage independently, and the ambient and cryogenic imaging performance of the fully assembled instrument. Interferometric measurements of subsystem wavefront error serve to venfy alignment, and are accomplished using a commercial, modified Twyman-Green laser unequal path interferometer. Image testing provides further verification of the optomechanical alignment method and a measurement of near-angle scattered light due to mirror small-scale surface error. Image testing is performed at multiple field points. A mercury-argon pencil lamp provides spectral lines at 546.1 nm and 1550 nm, and a CCD camera and IR camera are used as detectors. We use commercial optical modeling software to predict the point-spread function and its effect on instrument slit transmission and resolution. Our breadboard test results validate this prediction. We conclude with an instrument performance prediction for first light.

Author

Cryogenics; Infrared Spectrometers; Interferometry; Imaging Techniques; Alignment

20030113146 Norfolk State Univ., VA, USA

Design and Performance Tests of Ultra-Compact Calorimeters for High Energy Astrophysics

Salgado, Carlos W.; [2003]; 37 pp.; In English

Contract(s)/Grant(s): NAG5-8653; No Copyright; Avail: CASI; A03, Hardcopy

This R&D project had two goals: a) the study of general-application ultra-compact calorimetry technologies for use in High Energy Astrophysics and, b) contribute to the design of an efficient calorimeter for the ACCESS mission. The direct measurement of galactic cosmic ray fluxes is performed from space or from balloon-borne detectors. Detectors used in those studies are limited in size and, specially, in weight. Since galactic cosmic ray fluxes are very small, detectors with high geometrical acceptances and long exposures are usually required for collecting enough statistics. We have studied calorimeter

techniques that could produce large geometrical acceptance per unit of mass (G/w) and that may be used to study galactic cosmic rays at intermediate energies (knee energies).-The most important asset for detection of primary cosmic rays at and about the knee is large acceptance. To construct a large acceptance calorimeter (this term is used here in its most general accepted meaning of calorimeter as a device to measure particle energies) the detector needs to be verv liaht or verv shallow . We studied two possible technologies to built compact calorimeters: the use of lead-tungstate crystals (PWO) and the use of sampling calorimetry using scintillating fibers embedded in a matrix of powder tungsten. For a very light detector, we considered the possibility of using Optical Transition Radiation (OTR) to measure the energy (and perhaps also direction and identity) of VHE cosmic rays.
Author
Calorimeters; Galactic Cosmic Rays

20030113155 Cranfield Univ., Bedford, UK
Target Position and Trajectory Measurements by Videogrammetry
Hobbs, Stephen; November 2003; 70 pp.; In English
Report No.(s): COA-0208; Copyright; Avail: Other Sources

This report documents the algorithms, data processing and software for the video photogrammetry (videogrammetry) system developed at Cranfield University. Cranfield's system has been used successfully since 1999 on a range of measurement projects. Videogrammetry typically uses two video cameras to film the motion of target objects in stereo, and then with suitable image processing and data analysis the targets 3d trajectories are measured to good precision. The main features of the Cranfield systems are that it is based on consumer electronics devices (e.g. digital camcorders and PC's), and that it is designed as an experimental tool. Using consumer electronics provides good performance at low cost. Its experimental character means that an expert user is required, but does allow great flexibility. Current system performance derives from the image resolution of 1 mrad per pixel over a field of view 720 by 576 pixels, and a frame rate of 25 Hz. Two areas of work are described: (1) the mathematical models and algorithms used for calibration, position measurement and trajectory extraction, and (2) the software tools written to manipulate images and process the data. The model of the imaging system can be adapted for a wide range of applications, and is explicitly developed in this report for a single camera position and pose calibration, a two-camera system calibration, and a measurement system using two or more cameras (either the general non-linear case or a linear approximation). The image calibration (which converts image coordinates to geometrical angles of inclination and azimuth) is based on a 3rd order polynomial and achieves an accuracy equivalent to better than 1 pixel. Trajectories are obtained by either labelling targets or using kinematic rules. Two programs (AVI1 and mfitvid) have been written for the videogrammetry system and are described in outline (for a user and to support future development). Commercial software provides the more general functions required by the system. Experience with the videogrammetry system over a number of years gives confidence in its performance. Example results are provided to illustrate the type of measurements which are possible.
Author
Photogrammetry; Trajectory Measurement; Position (Location); Mathematical Models; Video Equipment

36
LASERS AND MASERS

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also *76 Solid-State Physics*.

20030112926 West Virginia Univ., Morgantown, WV
Development of Nonlinear Optical Materials (LBO, BBO, and KTP) for Use in High-Power Lasers
Halliburton, Larry E.; Giles, Nancy C.; Oct. 15, 2003; 12 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0301
Report No.(s): AD-A418265; AFRL-SR-AR-TR-03-0458; No Copyright; Avail: CASI; A03, Hardcopy

This is the final technical report for a three- year project to identify and characterize point defects in single crystals of LiB(3)O(5) (LBO), Beta-BaB(2) O(4) (BBO), KTiOPO(4) (KTP), KH(2)PO(4), and ZnO. These materials are used to generate ultraviolet laser beams, and their performance is often limited by the present of optically active point defects. In this project, we have investigated a variety of electron and hole traps and have shown how they affect the behavior of devices. The experimental techniques used to characterize the crystals were optical absorption, visible photoluminescence, electron

paramagnetic resonance (EPR), photoinduced EPR, and electron-nuclear double resonance (ENDOR). Industrial collaborators included Northrop Grumman (formerly Litton Airtron Synoptics), Lightwave Electronics, Crystal Associates, Cleveland Crystals, and Crystal Laser. Specific results during this project include: (1) a detailed characterization of Ti(3+) centers in KTP, (2) identification of self-trapped hole centers in LBO and BBO crystals, (3) identification of oxygen vacancies as the primary electron trap in LBO, BBO, and KH(2)PO(4) crystals, (4) production of neutral isolated nitrogen acceptors in ZnO crystals, and (5) observation of Ag(0) atoms and Ag(2+) ions after diffusion of silver into BBO crystals.
DTIC
Optical Materials; Ultraviolet Lasers; Product Development

39
STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structures. For applications see *05 Aircraft Design, Testing and Performance*; and *18 Spacecraft Design, Testing and Performance*.

20030113138 Virginia Univ., VA, USA
Load Diffusion in Composite and Smart Structures
Horgan, C. O.; [2003]; 9 pp.; In English
Contract(s)/Grant(s): NCC1-02019; No Copyright; Avail: CASI; A02, Hardcopy

The research carried out here builds on our previous NASA supported research on the general topic of edge effects and load diffusion in composite structures. Further fundamental solid mechanics studies were carried out to provide a basis for assessing the complicated modeling necessary for the multi-functional large scale structures used by NASA. An understanding of the fundamental mechanisms of load diffusion in composite subcomponents is essential in developing primary composite structures. Some specific problems recently considered were those of end effects in smart materials and structures, study of the stress response of pressurized linear piezoelectric cylinders for both static and steady rotating configurations, an analysis of the effect of pre-stressing and pre-polarization on the decay of end effects in piezoelectric solids and investigation of constitutive models for hardening rubber-like materials. Our goal in the study of load diffusion is the development of readily applicable results for the decay lengths in terms of non-dimensional material and geometric parameters. Analytical models of load diffusion behavior are extremely valuable in building an intuitive base for developing refined modeling strategies and assessing results from finite element analyses. The decay behavior of stresses and other field quantities provides a significant aid towards this process. The analysis is also amenable to parameter study with a large parameter space and should be useful in structural tailoring studies. Special purpose analytical models of load diffusion behavior are extremely valuable in building an intuitive base for developing refined modeling strategies and in assessing results from general purpose finite element analyses. For example, a rational basis is needed in choosing where to use three-dimensional to two-dimensional transition finite elements in analyzing stiffened plates and shells. The decay behavior of stresses and other field quantities furnished by this research provides a significant aid towards this element transition issue. A priori knowledge of the extent of boundary-layers induced by edge effects is also useful in determination of the instrumentation location in structural verification tests or in material characterization tests.
Derived from text
Composite Structures; Diffusion; Loads (Forces); Piezoelectricity; Smart Structures; Mathematical Models

20030113153 Southwest Research Inst., San Antonio, TX, USA
Addendum to the User Manual for NASGRO Elastic-Plastic Fracture Mechanics Software Module
Gregg, M. Wayne, Technical Monitor; Chell, Graham; Gardner, Brian; September 23, 2003; 143 pp.; In English
Contract(s)/Grant(s): NAS8-02051; SwRI Proj. 18-05756; No Copyright; Avail: CASI; A07, Hardcopy

The elastic-plastic fracture mechanics modules in NASGRO have been enhanced by the addition of of the following: new J-integral solutions based on the reference stress method and finite element solutions; the extension of the critical crack and critical load modules for cracks with two degrees of freedom that tear and failure by ductile instability; the addition of a proof test analysis module that includes safe life analysis, calculates proof loads, and determines the flaw screening 1 capability for a given proof load; the addition of a tear-fatigue module for ductile materials that simultaneously tear and extend by fatigue; and a multiple cycle proof test module for estimating service reliability following a proof test.
Author
Fracture Mechanics; User Manuals (Computer Programs); Elastoplasticity; Modules

42
GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see *categories 42 through 48*.

20030112847 NASA Langley Research Center, Hampton, VA, USA
Compendium of NASA Data Base for the Global Tropospheric Experiment's Transport and Chemical Evolution Over the Pacific (TRACE-P), Volume 1, DC-8
Kleb, Mary M.; Scott, A. Donald, Jr.; October 2003; 546 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WU 622-63-06-70
Report No.(s): NASA/TM-2003-212429/VOL1; L-18260A/VOL1; No Copyright; Avail: CASI; A23, Hardcopy

This report provides a compendium of NASA aircraft data that are available from NASA's Global Tropospheric Experiment's (GTE) Transport and Chemical Evolution over the Pacific (TRACE-P) Mission. The broad goal of TRACE-P was to characterize the transit and evolution of the Asian outflow over the western Pacific. Conducted from February 24 through April 10, 2001, TRACE-P integrated airborne, satellite- and ground-based observations, as well as forecasts from aerosol and chemistry models. The format of this compendium utilizes data plots (time series) of selected data acquired aboard the NASA/Dryden DC-8 (vol. 1) and NASA/Wallops P-3B (vol. 2) aircraft during TRACE-P. The purpose of this document is to provide a representation of aircraft data that are available in archived format via NASA Langley s Distributed Active Archive Center (DAAC) and through the GTE Project Office archive. The data format is not intended to support original research/analyses, but to assist the reader in identifying data that are of interest.
Author
Troposphere; Atmospheric Composition; Pacific Ocean; Data Bases

20030112852 NASA Langley Research Center, Hampton, VA, USA
Compendium of NASA Data Base for the Global Tropospheric Experiment's Transport and Chemical Evolution Over the Pacific (TRACE-P), Volume 2, P-3B
Kleb, Mary M.; Scott, A. Donald, Jr.; October 2003; 564 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WU 622-63-06-70
Report No.(s): NASA/TM-2003-212429/VOL2; L-18260B/VOL2; No Copyright; Avail: CASI; A24, Hardcopy

This report provides a compendium of NASA aircraft data that are available from NASA's Global Tropospheric Experiment's (GTE) Transport and Chemical Evolution over the Pacific (TRACE-P) Mission. The broad goal of TRACE-P was to characterize the transit and evolution of the Asian outflow over the western Pacific. Conducted from February 24 through April 10, 2001, TRACE-P integrated airborne, satellite- and ground based observations, as well as forecasts from aerosol and chemistry models. The format of this compendium utilizes data plots (time series) of selected data acquired aboard the NASA/Dryden DC-8 (vol. 1) and NASA/Wallops P-3B (vol. 2) aircraft during TRACE-P. The purpose of this document is to provide a representation of aircraft data that are available in archived format via NASA Langley's Distributed Active Archive Center (DAAC) and through the GTE Project Office archive. The data format is not intended to support original research/analyses, but to assist the reader in identifying data that are of interest.
Author
Troposphere; Atmospheric Composition; Air Sampling; Pollution Monitoring; Data Bases

43
EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photography. For related instrumentation see *35 Instrumentation and Photography*.

20030112881 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA, NASA Stennis Space Center, Bay Saint Louis, MS, USA
Use of GPR Surveys in Historical Archaeology Studies at Gainesville, Mississippi (22HA600)
Goodwin, Ben; Giardino, Marco; Spruce, Joseph P.; November 1, 2002; 25 pp.; In English; 59th Annual Meeting of the Southeastern Archaeological Conference, 6-9 Nov. 2002, Biloxi, MS, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2002-10-00074-SSC; Copyright; Avail: CASI; A03, Hardcopy

Ground Penetrating Radar (GPR) is used to study the underground remains of historic structures on the grounds of Stennis Space Center (SSC) in this viewgraph presentation. The main goal of the project described is to research, develop, and validate Remote Sensing (RS) and Geographic Information System (GIS) methods for aiding cultural resource assessments within SSC. The project georeferences historic imagery and maps to assist archaeological RS, field surveys, and excavations.
CASI
Archaeology; Remote Sensing; Surveys; Underground Structures; Cultural Resources; Geographic Information Systems; Ground Penetrating Radar

20030113190 NASA Stennis Space Center, Bay Saint Louis, MS, USA, Earth Satellite Corp., Rockville, MD, USA
NASA/USGS US Digital Landsat Moasaics
Stanley, Thomas M.; September 10, 2001; 2 pp.; In English
Contract(s)/Grant(s): NAS13-98046
Report No.(s): SE-2001-03-00017-SSC; No Copyright; Avail: Other Sources; Abstract Only

The Earth Satellite Corporation (EarthSat) has been providing orthorectified Landsat data to NASA.Also included are 5 degree by 6 degree mosaics for most of the planet. The Earth Science Applications Directorate developed a specialized viewer application to view and navigate these individual tiles. It is the intent of NASA to make this publicly available and useable through the distribution of the U.S. Digital Landsat Mosaic Product.
Author
Satellite Imagery; Mosaics

20030113208 Scripps Institution of Oceanography, La Jolla, CA, USA
Satellite Interferometric Observations of Displacements Associated with Seasonal Groundwater in the Los Angeles Basin
Watson, Karen M.; Bock, Yehuda; Sandwell, David T.; Journal of Geophyscial Research; 2002; ISSN 0148-0227; Volume 107, No. B4, pp. 1-18; In English
Contract(s)/Grant(s): NAS5-9623; NSF-EAR-9619201; NSF-EAR-8920136; USGS-14-08-0001; USGS-1432-HQ97AG01718; SCEC-623; Copyright; Avail: Other Sources

The Newport-Inglewood fault zone (NIFZ) displays interferometric synthetic aperture radar (SAR) phase features along most of its length having amplitudes of up to 60 mm. However, interpretation in terms of right-lateral, shallow slip along the fault fails to match the range of geologic estimates of slip. Recently, Bawden et al. proposed that these phase features, as well as a broader deformation pattern in the Los Angeles basin, are due to vertical motion related to annual variations in the elevation of the water table. We confirm this hypothesis through the analysis of a longer span of data consisting of 26 SAR images collected by the ERS-1 and ERS-2 spacecraft between June 1992 and June 2000. Moreover, we use continuous GPS measurements from 1995 to the present to establish the amplitude and phase of the vertical deformation. The Los Angeles basin becomes most inflated one quarter of the way through the year, which is consistent with water table measurements as well as with the end of the rainy season when the aquifer should be at a maximum. The spatial pattern of the amplitude of the annual signal derived from continuous GPS measurements is consistent with the shape of the interferometric fringes. GPS sites both near the NIFZ and in a 20 by 40 km zone within the basin also show significant N-S annual variations that may be related to the differential expansion across the fault. Since these horizontal signals have peak-to-trough amplitudes of 6 mm, they mask the smaller tectonic signals and need to be taken into account when interpreting GPS time series of site position. Moreover, since the groundwater signal appears to have a longterm vertical trend which varies in sign depending on location, it will be difficult to distinguish interseismic tectonic slip along the NIFZ and within the affected areas in the basin.
Author
Satellite Observation; Interferometry; Annual Variations; Ground Water; Aquifers

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20030112828 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Impact of Quikscat Data on Numerical Weather Prediction
Atlas, Robert; [2002]; 1 pp.; In English; American Geophysical Union Fall Meeting, 6-10 Dec. 2002, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

One of the important applications of satellite surface wind observations is to increase the accuracy of weather analyses and forecasts. Satellite surface wind data can improve numerical weather prediction (NWP) model forecasts by contributing to improved analyses of the surface wind field and air sea fluxes. Through the data assimilation process,these data can also improve atmospheric mass and motion fields in the free atmosphere above the surface. The SeaWinds scatterometer on the QuikScat satellite was launched in July 1999 and represented a dramatic departure in design from the other scatterometer instruments launched during the past decade (ERS-1,2 and NSCAT). The NASA Data Assimilation Office (DAO) was the first data assimilation center to assimilate QuikScat Seawinds data and evaluate their impact on numerical weather prediction. Following the launch of QuikScat, a detailed evaluation of the initial surface wind data sets was performed as part of a collaborative project between the Environmental Modeling Center of NCEP, NESDIS and the DAO. More recently, the impact of Quikscat data was evaluated in detailed experiments using the NCEP operational data assimilation system. As a result of the beneficial impact obtained, NCEP began operational utilization of Quikscat data. Results from these experiments as well as recent DAO assimilation experiments showing the impact of Quikscat data on stratospheric analyses and forecasts will be presented at the meeting.
Author
Numerical Weather Forecasting; Quikscat Satellite; Data Acquisition; Atmospheric Models

20030112857 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Various Numerical Applications on Tropical Convective Systems Using a Cloud Resolving Model
Shie, C.-L.; Tao, W.-K.; Simpson, J.; [2003]; 1 pp.; In English; Third International Ocean-Atmosphere Conference, 14-16 Jul. 2003, Beijing, China; No Copyright; Avail: Other Sources; Abstract Only

In recent years, increasing attention has been given to cloud resolving models (CRMs or cloud ensemble models-CEMs) for their ability to simulate the radiative-convective system, which plays a significant role in determining the regional heat and moisture budgets in the Tropics. The growing popularity of CRM usage can be credited to its inclusion of crucial and physically relatively realistic features such as explicit cloud-scale dynamics, sophisticated microphysical processes, and explicit cloud-radiation interaction. On the other hand, impacts of the environmental conditions (for example, the large-scale wind fields, heat and moisture advections as well as sea surface temperature) on the convective system can also be plausibly investigated using the CRMs with imposed explicit forcing. In this paper, by basically using a Goddard Cumulus Ensemble (GCE) model, three different studies on tropical convective systems are briefly presented. Each of these studies serves a different goal as well as uses a different approach. In the first study, which uses more of an idealized approach, the respective impacts of the large-scale horizontal wind shear and surface fluxes on the modeled tropical quasi-equilibrium states of temperature and water vapor are examined. In this 2-D study, the imposed large-scale horizontal wind shear is ideally either nudged (wind shear maintained strong) or mixed (wind shear weakened), while the minimum surface wind speed used for computing surface fluxes varies among various numerical experiments. For the second study, a handful of real tropical episodes (TRMM Kwajalein Experiment - KWAJEX, 1999; TRMM South China Sea Monsoon Experiment - SCSMEX, 1998) have been simulated such that several major atmospheric characteristics such as the rainfall amount and its associated stratiform contribution, the Qlheat and Q2/moisture budgets are investigated. In this study, the observed large-scale heat and moisture advections are continuously applied to the 2-D model. The modeled cloud generated from such an approach is termed continuously forced convection or continuous large-scale forced convection. A third study, which focuses on the respective impact of atmospheric components on upper Ocean heat and salt budgets, will be presented in the end. Unlike the two previous 2-D studies, this study employs the 3-D GCE-simulated diabatic source terms (using TOGA COARE observations) - radiation (longwave and shortwave), surface fluxes (sensible and latent heat, and wind stress), and precipitation as input for the Ocean mixed-layer (OML) model.
Author
Clouds (Meteorology); Forced Convection; Two Dimensional Models; Tropical Meteorology; Atmospheric Models

20030112959 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Effect of Smoke on Cloud Formation during the Biomass Burning Season over the Amazon Basin
Koren, I.; Kaufman, Y. J.; Remer, L. A.; [2003]; 1 pp.; In English; EGS-AGU-EUG Joint Assembly, 6-11 Apr. 2003, Nice, France; No Copyright; Avail: Other Sources; Abstract Only

Aerosol absorption of sunlight reduces surface irradiation and heats the aerosol layer. The consequent changes in the temperature and humidity profiles can affect cloud formation extent and life time, which is called the semi-direct effect. We evaluate this aerosol semi-direct effect using data collected during the 2002 biomass burning season over the Amazon basin from the MODIS instrument on the Aqua satellite. MODIS measures the cloud coverage and the aerosol optical thickness among the clouds. We found that the radiative heating of the atmosphere and cooling of the surface due to the presence of

the smoke decreases the cloud coverage. A very clear negative correlation emerges between the cloud fraction and the smoke optical depth. The results are compared to calculations using 1-D radiation model (M.D. Chou), and used to calculate this regional semi direct effect on climate forcing.
Author
Amazon Region (South America); Biomass Burning; Smoke; Structural Basins; Seasons; Clouds (Meteorology)

20030112960 NASA Goddard Space Flight Center, Greenbelt, MD, USA, Maryland Univ. Baltimore County, Catonsville, MD, USA
Derivation of Aerosol Columnar Mass from MODIS Optical Depth
Gasso, Santiago; Hegg, Dean A.; [2002]; 1 pp.; In English; American Geophysical Union Fall Meeting, 6-10 Dec. 2002, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

In order to verify performance, aerosol transport models (ATM) compare aerosol columnar mass (ACM) with those derived from satellite measurements. The comparison is inherently indirect since satellites derive optical depths and they use a proportionality constant to derive the ACM. Analogously, ATMs output a four dimensional ACM distribution and the optical depth is linearly derived. In both cases, the proportionality constant requires a direct intervention of the user by prescribing the aerosol composition and size distribution. This study introduces a method that minimizes the direct user intervention by making use of the new aerosol products of MODIS. A parameterization is introduced for the derivation of columnar aerosol mass (AMC) and CCN concentration (CCNC) and comparisons between sunphotometer, MODIS Airborne Simulator (MAS) and in-measurements are shown. The method still relies on the scaling between AMC and optical depth but the proportionality constant is dependent on the MODIS derived r$_{eff}$,\eta (contribution of the accumulation mode radiance to the total radiance), ambient RH and an assumed constant aerosol composition. The CCNC is derived fkom a recent parameterization of CCNC as a function of the retrieved aerosol volume. By comparing with in-situ data (ACE-2 and TARFOX campaigns), it is shown that retrievals in dry ambient conditions (dust) are improved when using a proportionality constant dependent on r$ {eff}$ and \eta derived in the same pixel. In high humidity environments, the improvement inthe new method is inconclusive because of the difficulty in accounting for the uneven vertical distribution of relative humidity. Additionally, two detailed comparisons of AMC and CCNC retrieved by the MAS algorithm and the new method are shown. The new method and MAS retrievals of AMC are within the same order of magnitude with respect to the in-situ measurements of aerosol mass. However, the proposed method is closer to the in-situ measurements than the MODIS retrievals. The retrievals of CCNC are also within the same order of magnitude for both methods. The new method is applied to an actual MODIS retrieval and although no in-situ data is available to compare, it is shown that the proposed method yields more credible values than the MODIS retrievals. In addition, recent data available from the PRIDE (Puerto Rico Dust Experiment, July 2000) will be shown by comparing sunphotometer, MODIS and in-situ data.
Author
Aerosols; Optical Thickness; MODIS (Radiometry); Imaging Spectrometers; Parameterization

20030112964 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Towards Improved MODIS Aerosol Retrieval over the US East Coast Region: Re-examining the Aerosol Model and Surface Assumptions
Levy, R. C.; Remer, L. A.; Kaufman, Y. J.; Holben, B. N.; [2002]; 1 pp.; In English; American Geophysical Union Fall Meeting, 6-10 Dec. 2002, San Francisco, CA, USA; Copyright; Avail: Other Sources; Abstract Only

The MODerate resolution Imaging Spectrometer (MODIS) aboard the Terra and recently the Aqua platform, produces a set of aerosol products over both ocean and land regions. Previous validation efforts have shown that from a global perspective, aerosol optical depth (AOD) is successfully retrieved from MODIS. Even over coastal regions, the over- land and over-ocean retrievals are consistent with each other, and well matched with ground-based sunphotometer measurements (such as AERONET). However, the East Coast of the USA is one region where there is consistently a discrepancy between land and ocean retrievals. Over the ocean, MODIS AODs are consistent with coastal sunphotometer measurements, but over land, AODs are consistently over- estimated. In this study we use field data from the Chesapeake Lighthouse and Aircraft Measurements for Satellites experiment (CLAMS), (held during summer 2001) to determine the aerosol properties at a number of sites. Using the 6-S radiative transfer package, we compute simulated satellite radiances and compare them with observed MODIS radiances. We believe that the AOD over-estimation is not likely due to an incorrect choice of the urban/industrial aerosol models. Using 6-S to do an atmospheric correction for a very low AOD case, we show rather, that the discrepancies are likely a result of incorrect assumptions about the surface reflectance properties. Understanding and improving MODIS

retrievals over the East Coast will not only improve the global quality of MODIS, but also would enable the use of MODIS as a tool for monitoring regional aerosol events.
Author
Aerosols; MODIS (Radiometry); Atmospheric Models; Satellite Instruments; Coasts

20030112965 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Aerosol Absorption in the Atmosphere: Perspectives from Global Model, Ground-Based Measurements, and Field Observations
Chin, Mian; Holben, Brent; Anderson, Tad; Quinn, Patricia; Duncan, Bryan; Ginoux, Paul; [2003]; 1 pp.; In English; EGS-AGU-EUG Joint Assembly 2003, 7-11 Apr. 2003, Nice, France; No Copyright; Avail: Other Sources; Abstract Only

Aerosol absorption in the atmosphere poses a major uncertainty in assessing the aerosol climate effects. This uncertainty arises from the poorly quantified aerosol sources, especially black carbon emissions, and our limited knowledge of aerosol mixing state and optical properties. Here we use a global model GOCART to simulate atmospheric aerosols, including sulfate, black carbon, organic carbon, dust, and sea salt. We compare the model calculated total aerosol optical thickness, extinction, and absorption with those quantities from the ground-based sun photometer measurements from AERONET at several different wavelengths and the field observations from ACE-Asia. We will examine what are the most sensitive factors in determining the aerosol absorption, and the consequences of assessing the aerosol radiative forcing and atmospheric heating associated with those factors.
Author
Aerosols; Absorption; Earth Atmosphere; Atmospheric Models

20030112967 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Updated Umkehr Ozone Retrieval Algorithm and its Validation against Satellite Data
Petropavlovskikh, I.; Bhartia, P. K.; Labow, G.; Wellemeyer, C.; [2003]; 1 pp.; In English; EGS-AGU-EUG Joint Assembly, 7-11 Apr. 2003, Nice, France; No Copyright; Avail: Other Sources; Abstract Only

Improvements to the Umkehr ozone profile retrieval algorithm have been developed and are now being evaluated. The updated algorithm is able to simulate observations more accurately and provides data output that is easier to analyze. Among the new diagnostic capabilities that the updated algorithm provides is the averaging kernel (AK) method. The AK approach allows studying how the algorithm responds when a small perturbation is made in a particular layer of the atmosphere [Rodgers 1976, 1990]. We will use the AK method to define precisely what Umkehr should measure given a set of profiles measured by other platforms. This method allows us to compare trends and offsets in data more accurately than it has been done in the past. The updated Umkehr retrievals will be validated against SAGE II ozone profiles as well as SSBUV ozone profile data. We will discuss possible reasons for offset between data and differences in derived ozone profile trends. Considerable variability of the ozone profile within the 10-degree latitude envelope creates noise in the SAGE matching dataset and makes comparisons difficult. To eliminate this problem, the SAGE and Umkehr data had been previously de-seasonalized by subtracting the latitude/season dependent ozone climatology. However, the remaining noise in the ozone residuals was still considerably high for trend analysis and was attributed to longitude variability of SAGE sampling. The new ozone climatology (Labow, NASA) that has longitude dependent ozone variability will be used to minimize contribution of sampling noise in comparisons of satellite and ground station. The comparison of zenith-sky radiances (Umkehr N-value measurements) synthesized for a given set of SAGE profiles will be used to determine whether SAGE-derived N-values agree with the Umkehr-measured N-values. The instrumental effects will be discussed. Both the Umkehr data and SAGE II measurements will be analyzed for their information about ozone variability and loss and recovery rates at the mid- and upper (40 km) levels. The updated long-term Umkehr dataset can be used to provide high quality information for identifying signs of ozone recovery. The long Umkehr historical record can provide additional information for separating the dynamic and chemical mechanisms of depletion, and can help the community better understand climate change effects.
Author
Algorithms; Ozone; Umkehr Effect; Data Acquisition; Sage Satellite

20030112972 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Modeling Study of Planetary Waves in the Mesosphere Lower Thermosphere (MLT)
Mengel, J. G.; Mayr, H. g.; Drob, D.; Porter, H. S.; Hines, C. O.; [2003]; 1 pp.; In English; EGS-AGU-EUG Joint Assembly 2003, 7-11 Apr. 2003, Nice, France; Copyright; Avail: Other Sources; Abstract Only

For comparison with measurements from the TIMED satellite and coordinated ground based observations, we present

results from our Numerical Spectral Model (NSM) that incorporates the Doppler Spread Parameterization (Hines, 1997) for small-scale gravity waves (GWs). We discuss the planetary waves (PWs) that are purely generated by dynamical interactions, i.e., without explicitly specifying excitation sources related for example to tropospheric convection or topography. With tropospheric heating that reproduces the observed zonal jets near the tropopause and the accompanying reversal in the latitudinal temperature variation, which is conducive to baroclinic instability, long period PWs are produced that propagate up into the stratosphere to affect the wave driven equatorial oscillations (QBO and SAO) extending into the upper mesosphere. The PWs in the model that dominate higher up in the MLT region, however, are to a large extent produced by instabilities under the influence of the zonal circulation and temperature variations in the middle atmosphere and they are amplified by GW interactions. Three classes of PWs are generated there. (1) Rossby waves that slowly propagate westward but are carried by the zonal mean (m = 0) winds to produce eastward and westward propagating PWs respectively in the winter and summer hemispheres below 80 km. Depending on the zonal wave number and magnitudes of the zonal winds under the influence of the equatorial oscillations, the PWs typically have periods between 2 and 20 days and their horizontal wind amplitudes can exceed 40 m/s in the lower mesosphere. (2) Rossby gravity waves that propagate westward at low latitudes, having periods around 2 days for zonal wave numbers m = 2 to 4. (3) Eastward propagating equatorial Kelvin waves generated in the upper mesosphere with periods between 2 and 3 days for m = 1 & 2. The seasonal variations of the PWs reveal that the largest wind amplitudes tend to occur below 80 km in the winter hemisphere, but above that altitude in the summer hemisphere to approach magnitudes as large as 50 m/s.

Author

Mathematical Models; Mesosphere; Planetary Waves; Thermosphere

20030112974 Maryland Univ., College Park, MD, USA

SPARC-IGAC Symposium on Climate-Chemistry Interactions. Climate Feedback by Water Vapor in the Tropical Upper Troposphere

Dessler, A. E.; Minschwaner, K.; [2003]; 1 pp.; In English; EGS-AGU-EUG Joint Assembly 2003, 6-11 Apr. 2003, Nice, France; Copyright; Avail: Other Sources; Abstract Only

The strong greenhouse forcing by atmospheric water vapor is expected to play an important role in shaping the direction of any future changes in climate. We present calculations that provide a new perspective on the sensitivity of upper tropospheric water vapor to changes in surface temperature. Equilibrium states of our atmospheric model show unambiguously that as the surface warms, changes in the vertical distribution and temperature of detraining air parcels from tropical convection lead to higher water vapor mixing ratios in the upper troposphere. However, the increase in mixing ratio is not as large as the increase in saturation mixing ratio due to warmer environmental temperatures, so that the relative humidity decreases. Our analysis suggests that models that maintain a fixed relative humidity are likely overestimating the magnitude of the water vapor feedback.

Author

Climate Change; Water Vapor; Troposphere; Tropical Regions

20030113045 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Non-Migrating Tides, with Zonally Symmetric Component, Generated in the Mesosphere

Mayr, H. G.; Mengel, J. G.; Talaat, E. R.; Porter, H. S.; Hines, C. O.; [2003]; 1 pp.; In English; EGS-AGU-EUG Joint Assembly 2003, 7-11 Apr. 2003, Nice, France; No Copyright; Avail: Other Sources; Abstract Only

For comparison with measurements from the TIMED satellite and coordinated ground based observations, we discuss results from our Numerical Spectral Model (NSM) that incorporates the Doppler Spread Parameterization (Hines, 1997) for small-scale gravity waves (GWs). The NSM extends from the ground into the thermosphere and describes the major dynamical features of the atmosphere including the wave driven equatorial oscillations (QBO and SAO), and the seasonal variations of tides and planetary waves. With emphasis on the non-migrating tides, having periods of 24 and 12 hours, we discuss our modeling results that account for the classical migrating solar excitation sources only. As reported earlier, the NSM reproduces the observed seasonal variations and in particular the large equinoctial maxima in the amplitude of the migrating diurnal tide at altitudes around 90 km. Filtering of the tide by the zonal circulation and GW momentum deposition was identified as the cause. The GWs were also shown to produce a strong non-linear interaction between the diurnal and semi-diurnal tides. Confined largely to the mesosphere, the NSM produces through dynamical interactions a relatively large contribution of non-migrating tides. A striking feature is seen in the diurnal and semi-diurnal oscillations of the zonal mean (m = 0). Eastward propagating tides are also generated for zonal wave numbers m = 1 to 4. When the NSM is run without GWs, the amplitudes for the non-migrating tides, including m = 0, are generally small. Planetary wave interaction and non-linear coupling that involves the filtering of GWs and related height integration of dynamical features are discussed as possible mechanisms for

generating these non-migrating tides in the NSM. As is the case for the solar migrating tides, the non-migrating tides reveal persistent seasonal variations. Under the influence of the QBO and SAO, interannual variations are produced.
Author
Mathematical Models; Mesosphere; Tides; Zonal Flow (Meteorology); Symmetry

20030113209 Colorado Research Associates, Inc., Boulder, CO, USA
Analysis of Diurnal, Planetary and Mean Wind Activity using TIMED, MF and Meteor Radar Winds
Lieberman, Ruth S.; Riggin, Dennis R.; December 08, 2003; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NASW-00040
Report No.(s): NWRA-CoRA-03-R269; No Copyright; Avail: CASI; A02, Hardcopy

The goals of this research are: 1) To validate TIMED Doppler Interferometer (TIDI) winds using ground-based MF and meteor winds; and 2) To examine short-term (i. e., day-to-day and week-to-week) variability of the diurnal tide. This objective was to have originally been met using comparisons of short-term diurnal tidal determinations from ground-based (GB) winds with planetary-scale diurnal nonmigrating tidal definitions from TIDI winds.
Author
Diurnal Variations; Interferometers; Planetary Waves; Doppler Radar; Wind (Meteorology)

51
LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.

20030112891 University of South Florida, Tampa, FL
Optimization of CAD System Using Adaptive Simulated Annealing for Digital Mammography
Sun, Xuejun; Qian, Wei; Jul. 2003; 9 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0396
Report No.(s): AD-A418349; No Copyright; Avail: CASI; A02, Hardcopy

Mammography is the most effective method to date and is becoming a high volume X-ray procedure for screening and diagnosing breast cancer. The performance of computer- aided detection and diagnosis (CAD) scheme determines its clinical effectiveness as an objective 'second reader' in aiding radiologists' mammogram interpretation. Following research work of initial grant year, the major research works in the second grant year are: (1) to construct CAD system robust to FFDM and SFM, (2) to fully optimize the CAD system for its overall performance improvements in both sensitivity and specificity. The major accomplishments in the second grant year are as follows: (1) New modules have been developed, including preprocessing for normalization of mammographic images from PFDM and SFM, adaptive Fuzzy-C means algorithm for segmentation, support vector machine (SVM) technique for classification. Adaptive modules have been modified based on existing modules. (2) Adaptive CAD system has been constructed using developed and modified modules. (3) Fully optimization of CAD system by simulated annealing (SA) algorithm has been developed and performed. Key parameters affecting performance of CAD system have been selected as optimization variables. Modular and full system optimizations have been performed, respectively, on CAD system.
DTIC
Computer Aided Design; Mammary Glands; Optimization; Simulated Annealing; Cancer; Digital Systems

20030112894 University of Southern California, Los Angeles, CA
Breast Cancer Susceptibility Genes in High Risk Women
Hamilton, Ann S.; Jul. 2003; 23 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0431
Report No.(s): AD-A418351; No Copyright; Avail: CASI; A03, Hardcopy

A positive family history, present in about 30% of breast cancer cases, has been shown to double a woman's risk of breast cancer. The genetic factors responsible are largely unknown, although the autosomal dominant, relatively high penetrant genes BRCA1/2 may account for 3%. It has been hypothesized that susceptibility genes of lower penetrance may also affect breast cancer risk, and a likely group of such genes are those that regulate the production, intracellular transport, and metabolism of estrogen. Previous studies of these susceptibility genes have not been conducted with women with high familial risk. This

study is being conducted with identical twins with differing genetic risks (i.e. concordant for breast cancer pairs vs. discordant pairs) as well as unaffected controls. We have chosen to focus on those genes related to estrogen metabolism and carcinogen metabolism. In the estrogen metabolism pathway, polymorphisms have been described related to the CYP17 gene, the CYP 19 gene, the COMT gene, and the HSD17B1 gene. Genes related to carcinogen metabolism which have been linked to breast cancer risk include GSTM1 and Pt and CYP1A1. We will compare the frequency of selected polymorphisms in these genes in 200 breast cancer concordant, 200 discordant, and 200 control women. We currently have tissue or buccal smears and informed consents from 130 concordant, 152 discordant, and 133 control women. Laboratory analyses of the CYP17 gene have shown some inconsistencies with repeat testing and additional testing is being done to assure that the results are accurate. Once the assay method has been validated, additional genes will be tested..
DTIC
Cancer; Mammary Glands; Risk; Genetics; Females

20030112898 Vanderbilt Univ., Nashville, TN
Folate and Breast Cancer: Role of Intake, Blood Levels and Metabolic Gene Polymorphisms
Shrubsole, Martha J.; Zheng, Wei; Jun. 2003; 30 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0606
Report No.(s): AD-A418353; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this application is training in nutritional and molecular epidemiology with the eventual goal of establishing an independent investigator. The hypothesis major hypothesis of the project is that high folate intake is associated with a decreased breast cancer risk particularly among those with MTHFR, MTR, and MTRR polymorphisms. The specific aims of this postdoctoral training proposal are 1) further methodological training in the analysis of gene-gene and gene-environment interactions by studying folate intake and folate metabolic gene polymorphisms (MTHFR, MTR, MTRR) using data collected in a population-based breast cancer case- control study (approximately 3000 subjects), 2) training in the methodology of cohort studies through designing and implementing a newly proposed nested case-control study of breast cancer (350 pairs) to examine folate intake, plasma folate, and metabolic gene polymorphisms, 3) coursework in nutrition and cancer biology and 4)participation in the field work of a recently submitted breast cancer case-control study and 5) development of a grant proposal examining folate, global DNA methylation and uracil misincorporation in breast cancer risk.
DTIC
Blood; Cancer; Epidemiology; Mammary Glands; Metabolism; Polymorphism

20030112904 Stanford Univ., Stanford, CA, USA
Beam Delivery Verification for Modulated Electron Radiation Therapy Treatment of Breast Cancer
Ponineau, Maxime; Boyer, Arthur L.; Aug. 2003; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0402
Report No.(s): AD-A418355; No Copyright; Avail: CASI; A02, Hardcopy

Detecting and monitoring cellular and molecular changes associated with cancer are essential to the verification of cancer treatment. In this investigation we show that modulated electron radiation therapy can in principle conform a region of high dose to a volume of malignant breast tissue. Currently available means to both measure the malignant volume and record progression of its response to radiation are limited. We therefore chose to explore another means to determine the breast treatment target; optical tomography. Using the fact that mammalian tissues transmit light at a low level and emit virtually no light at all, optical signatures conferred on tumor cells by expression of reporter genes can be detected externally by photon-detecting systems. In this paper we study a first approach to a gradient-based iterative procedure using a finite-difference scheme as forward model. We provide results at the current state of research and discuss ways to address current limitations.
DTIC
Mammary Glands; Radiation Therapy; Electron Radiation; Genes; Cancer

20030112906 Long Island Jewish Medical Center, New Hyde Park, NY, USA
Neural Protein Synuclein Gamma (SNCG) in Breast Cancer Progression
Jiang, Yangfu; Jul. 2003; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0352
Report No.(s): AD-A418359; No Copyright; Avail: CASI; A02, Hardcopy

Synucleins are emerging as a central player in the fundamental neural processes and in the formation of pathologically insoluble deposits characteristic of Alzheimer's (AD) and Parkinson's (PD) diseases. However, the normal cellular function

of this highly conserved synuclein family remains largely unknown. Using differential cDNA sequencing approach, we first identified a breast cancer specific gene, BCSG1, which was expressed abundantly in metastatic breast cancer cDNA library but scarcely in normal breast cDNA library. Interestingly, BCSG1 revealed no homology to any other known growth factors or oncogenes; rather, BCSG1 revealed extensive sequence homology to neurotic proteins of alpha synuclein and beta synuclein, and thus was also named as gamma Synuclein (SNCG). SNCG expression is highly associated with breast cancer and ovarian cancer progression. In addition, overexpression of SNCG in breast cancer cells significantly stimulated cell growth in vitro and tumor metastasis in vivo. However, the molecular targets of SNCG aberrant expression for breast cancer have not been identified. For the first time, we report a chaperone-like activity of SNCG in stimulating the transcriptional activity of estrogen receptor-alpha(ER-alpha) in breast cancer cells. Consistent with the stimulation of ER- alpha, SNCG stimulated the ligand-dependent cell proliferation. While overexpresssion of SNCG stimulated the ligand-dependent cell proliferation, suppression of endogenous SNCG expression significantly inhibited cell growth in response to estrogen. The stimulatory effect of SNCG on ERalpha-regulated gene expression and cell growth can be effectively inhibited by antiestrogens. Demonstration of the stimulation of ER-alpha signaling as one of the cellular functions of SNCG will have a great impact on the biology of steroid receptors and the pathological role of SNCG on hormone-responsive tumors including breast, ovary, and prostate.
DTIC

Cancer; Mammary Glands; Oncogenes; Proteins; Gene Expression; Pathology

20030112910 Trex Enterprises Corp., USA

Remote Access to Medical Specialists (RAMS) - Remote Patient Care Monitoring Test Bed

Martin, Peter J.; Oct. 2003; 14 pp.; In English

Contract(s)/Grant(s): DAMD17-01-C-0037

Report No.(s): AD-A418365; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this program is to demonstrate the applicability of advanced digital medicine techniques to military medicine. It consists of two parts: Critical Care and Chronic Care. The Critical Care portion of this program enables a doctor at Tripler Army Medical Center (TAMC) to view patients and data from patients in the ICU at USNH Guam. This portion of the program was subcontracted to VISICU, a company which has installed --somewhat similar systems in the past. The Chronic Care portion is intended to enable a physician to monitor blood glucose and blood pressure taken by patients in their homes form the physician's office. The hardware and software components for the Chronic Care portion are largely complete. The components work in a test setting, but due to difficulties obtaining approvals form IRB and other relevant groups, the hardware and software have not been tested in a doctor/patient setting during this program.
DTIC

Medical Science; Patients; Military Operations

20030112966 Anteon Corp., Fairfax, VA, USA

The Development of the Tactical Medical Logistics Planning Tool (TML+)

Tropeano, Anne; Konoske, Paula; Mitchell, Ray; Brock, Johnny; Parker, Joe; Oct. 31, 2003; 23 pp.; In English

Contract(s)/Grant(s): Proj-M0095

Report No.(s): AD-A418273; No Copyright; Avail: CASI; A03, Hardcopy

The Tactical Medical Logistics Planning Tool (TML+) is a software program designed for Navy and Marine Corps medical planners as a tool that: (1) models the patient flow from the point of injury through more definitive care, and (2) supports operations research and systems analysis studies, operational risk assessment, and field medical services planning. TML+ is designed with a user-friendly graphical user interface, an open architecture, and four program modules. The casualty generation module uses an exponential distribution to stochastically generate wounded in action, disease, and nonbattle injuries. The care-providing module uses generic task sequences; simulated treatment times; and personnel, consumable supply, and equipment requirements to model patient treatment and queuing within a functional area. The network/transportation module simulates the evacuation (including queuing) and routing of patients through the network of care via transportation assets. The reporting module produces an Access database detailing myriad metrics, such as patient disposition, time-in-system data, and consumable, equipment, personnel and transportation usage, which can be filtered according to the user's needs. TML+ can be used before deployment as a deliberate planning tool or during deployment as a crisis-action tool that assists planners in responding to the rapidly changing wartime environment.
DTIC

Computerized Simulation; Medical Services; Logistics; Injuries; Planning; Combat; Tactics

20030112982 Ohio State Univ., Columbus, OH, USA

The Effect of COX-2 Inhibitors on the Aromatase Gene Expression in Human Breast Cancer

Shapiro, Charles L.; Burak, William; Brueggemeier, Robert; Jun. 2003; 4 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0589

Report No.(s): AD-A418325; No Copyright; Avail: CASI; A01, Hardcopy

Aromatase (CYP-19) is responsible for estrogen biosynthesis within breast tumor tissue. Aromatase and cyclooxygenase-2 (COX-2) are both overexpressed in human breast cancer, and increased levels of prostaglandin (PG) activates the CYP19 promotor and increases gene expression. We hypothesize that celecoxib, a selective COX-2 inhibitor, will decrease PG, decrease the expression of CYP19, and reduce estrogen biosynthesis within tumor tissue. To test this hypothesis, in DOD grant # DAMD17-01-1-0589, tumor tissue will be collected from breast cancer patients at the initial diagnosis, and again at the definitive surgery (lumpectomy or mastectomy) for breast cancer. In the 10-14 day interval before the definitive surgery, patients will receive celecoxib and tissue samples collected before and after treatment with celecoxib will be evaluated for gene expression of COX-2 and CYP19. If our hypothesis is correct, then expression of the CYP19 gene will decrease in response to celecoxib. This study will provide preliminary data to a) support a mechanism whereby COX-2 inhibitors decrease estrogen production within breast tumors by decreasing CYP19 expression; and b) provide the rationale for initiating larger chemoprevention and therapeutic trials of COX-2 inhibitors in high risk and breast cancer patients.

DTIC

Mammary Glands; Cancer; Inhibitors; Tumors; Gene Expression

20030113006 Sloan-Kettering Inst. for Cancer Research, New York, NY

Gene Expression Analysis of Breast Cancer Progression

Gerald, William L.; Jul. 2003; 6 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0484

Report No.(s): AD-A418336; No Copyright; Avail: CASI; A02, Hardcopy

Breast cancer (BC) is a heterogeneous disease with varying clinical behavior, and response to therapy that cannot be predicted based on clinical and pathologic classifications. It is the primary goal of our research to identify and characterize biological pathways and individual molecular components that play a primary role in BC development and progression. In order to identify genes, gene expression profiles and molecular pathways associated with metastatic BC we have performed genome-wide gene expression analysis of a large number of breast cancer samples. Both unsupervised and supervised analyses are being used to identify genes differentially expressed among samples. Hierarchical clustering showed that most samples grouped according to estrogen receptor status. In addition, matched primary carcinomas and lymph node metastases tended to pair demonstrating marked conservation of molecular phenotype within patients. Formal statistical testing is being used to identify genes with marked changes in expression during progression. Lymph node metastases in particular showed significant decreases in the expression of many genes corresponding to extracellular matrix proteins and proteases when compared to matched primaries. Further expression changes in a variety of genes were associated with distant metastases. Immunohistochemistry and in situ hybridization are being used to validate and extend findings.

DTIC

Mammary Glands; Cancer; Gene Expression; Responses; Activity (Biology)

20030113050 Texas Univ., Houston, TX, USA

The Role of MEKK3 Signaling Pathway in the Resistance of Breast Cancer Cells to TNF- (alpha) -Mediated Apoptosis

Huang, Qiaojia; May 2003; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0449

Report No.(s): AD-A418337; No Copyright; Avail: CASI; A02, Hardcopy

In the past year, I focused my research on testing the hypothesis is that NF-kB activation in breast cancer cells plays a critical role in cancer cells' resistance to anti- cancer drugs and to TNF-alpha treatment, and MEKK3 is an essential component of this process. I constructed expression vectors that express dominant negative forms of MEKK3 that will be used to block the MEKK3-down stream cascades. I tested their expression and activities in various cells and found that the transfection efficiency in breast cancer cells is very low as compared to other cell lines such as COS-1 and 293T. In order to utilize these constructs in breast cancer cell, it is necessary to make retroviral vectors. This work is currently in progress. The second part of my research involves assaying NF-kB activation since it is the key target of MEKK3. I tested the NF-kB reporter activation, IkBa degradation, and NF-xB DNA binding activity. Finally, I have been working on the siRNA technique so that we can use MEKK3 SIRNA to inhibit the MEKK3 expression in breast cancer cells, and then test whether this will

render the cancer cells sensitive to TNF- alpha and hopefully to other anti-cancer drugs as well.
DTIC
Mammary Glands; Cancer; Apoptosis; Deoxyribonucleic Acid

20030113142 NASA Marshall Space Flight Center, Huntsville, AL, USA
Tindallia californiensis sp. nov., a new anaerobic, haloalkaliphilic, spore-forming acetogen isolated from Mono Lake in California
Pikuta, E. V.; Hoover, R. B.; Bej, A. K.; Marsic, D.; Detkova, E. N.; Whitman, W. B.; Krader, P.; Extremophiles; May 1, 2003; Volume 7, pp. 327-334; In English; Copyright; Avail: Other Sources

A novel extremely haloalkaliphilic, strictly anaerobic, acetogenic bacterium strain APO was isolated from sediments of the athalassic, meromictic, alkaline Mono Lake in California. The Gram-positive, spore-forming, slightly curved rods with sizes 0.55- 0.7x1.7-3.0 microns were motile by a single laterally attached flagellum. Strain APO was mesophilic (range 10-48 C, optimum of 37 C); halophilic (NaCl range 1-20% (w/v) with optimum of 3-5% (w/v), and alkaliphilic (pH range 8.0-10.5, optimum 9.5). The novel isolate required sodium ions in the medium. Strain APO was an organotroph with a fermentative type of metabolism and used the substrates peptone, bacto-tryptone, casamino acid, yeast extract, L-serine, L-lysine, L-histidine, L-arginine, and pyruvate. The new isolate performed the Stickland reaction with the following amino acid pairs: proline + alanine, glycine + alanine, and tryptophan + valine. The main end product of growth was acetate. High activity of CO dehydrogenase and hydrogenase indicated the presence of a homoacetogenic, non-cycling acetyl-coA pathway. Strain APO was resistant to kanamycin but sensitive to chloramphenicol, tetracycline, and gentamycin. The G+C content of the genomic DNA was 44.4 mol% (by HPLC method). The sequence of the 16s rRNA gene of strain APO possessed 98.2% similarity with the sequence from Tindullia magadiensis Z-7934, but the DNA-DNA hybridization value between these organisms was only 55%. On the basis of these physiological and molecular properties, strain APO is proposed to be a novel species of the genus Tindallia with the name Tindallia californiensis sp. nov., (type strain APO = ATCC BAA-393 - DSM 14871).
Author
Bacteria; Anaerobes; Lakes; Mesophiles; Halophiles; Alkalinity

52
AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments, see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

20030112895 Institute of Space Medico-Engineering, Beijing, China
Hangtian Yixue Yu Yixue Gongcheng) Volume 16, Number 2, April 2003
Feb. 2003; 88 pp.; In Chinese
Report No.(s): PB2004-100911; No Copyright; Avail: CASI; A05, Hardcopy

Contents: Effects of Dietary Supplementation of Certain Nutrients on Maze Performance and Biochemica Indices in Mice after Exposure to High + Gz; Changes of Reactivity of Rabbit Femoral Venous Rings after 21 d Simulated Weightlessness; Induced Vestibular Disorders in Guinea Pigs and Its Countermeasure by Preconditioning; Effects of 21 d-6 deg Head Down Bed-rest on Pulmonary Gas Distribution and Little Airway Function; Preventive Effects of Exercise Training on Bone Loss during 21 d-6 deg Head down Bed-rest; Preliminary Study on Effects of 'Planning Treatment According to Diagnosis' on Physiological Changes during Simulated Weightlessness; Effects of 'Quiang Gu Kang Wei' Compound Prescription on Biochemical Indices of Bone and Related Organs in Rats under Simulated Weightlessness; Effects of 'Qiang Gu Kang Wei' Compound Prescription on Bone Metabolism in Rats under Simulated Weightlessness; Observation on Protective Effect of Hearing Protectors on Infrasound; Effects of Infrasound on Visual Electrophysiology in Mice; Effects of Rotating Clinostat Simulated Weightlessness on the Differentiation-related Gene Expression of ROS17/2.8 Cells; Recognition of Eastern and Western Faces with Internal and External Features: An ERP Study; Physical Simulation of Human Body Metabolism in Sealed Module on the Ground; Analysis of Non-Fourier Effect and Laser-induced Thermal Damage of Laser-irradiated Layered Human Skin Tissue; An Adaptive Algorithm for Reducing Reverberation; Integer Multiple Rhythm in the Spontaneous Beating Rhythm of Cardiac Myocytes and its Possible Mechanism; Detection of Single-nucleotide Polymorphism in the 5'-flanking Region of the Human Tissue Kallikrein Gene; Signal Detection and Analysis of the Transient-evoked Otoacoustic

Emissions and its Applications; and Weightlessness or Weightlessness Simulation and Vascular Remodeling.
NTIS
Aerospace Medicine; Medical Equipment; China

20030112901 Institute of Space Medico-Engineering, Beijing, China
Hangtian Yixue Yu Yixue Gongcheng) Volume 15, Number 2, April 2002
Wei, J. H.; 2003; 88 pp.; In Chinese
Report No.(s): PB2004-100899; No Copyright; Avail: CASI; A05, Hardcopy

Contents include the following: Effects of Simulated Microgravity on Characteristics of Photosynthesis in Plant Seedling (in English); Effects of Lower Body Negative Pressure in the First and Last Week on Orthostatic Tolerance and Cardiac Function during 21 d Head-down Bed Rest; Assessment of Autonomic Nervous Function during Orthostatic Stress in Pilots with History of Syncope; Effects of Head-down bed Rest Changes of Surface Temperature Distribution Induced by and Non-evaporative Heat Dissipation; An Algorithm for Premature Ventricular Contraction Classification Based on the Combination of Template Matching and Characteristic Recognition; Theoretical Analysis on Heat Transfer Process in Living Tissues Subjected to Continuous Laser Ablation; Discharge Patterns of Neurons under Sinusoidal Current Stimulation; Dynamic 3D Reconstruction of Doppler Flow Ultrasound Medical Images; Electrocardiogram Data Compression by Bi-directional Wavelet Transform; A Gait Analysis System Based on Digital Video and Digital Image Processing; Studies on Character Variation of Parent of 'Ganzaoxian 47' by Space Mutation; Cardiac Myocyte Mechanics and Myosin Heavy Chain Gene Expression in Cultured Myocytes Infected with Coxsackievirus B3; The Quantitative Measurement of Several Main Contaminants in Sealed Cabin; Upright Tilt Table Testing and Syncope Evaluation; Changes of Leg Compliance during Weightlessness of Simulated Weightlessness; Low-density Lipoprotein Apheresis; Effects of Nitric Oxide on Myocardial Contraction Function; and Research Progresses of the Synthesis and Application of Oligopeptide Containing Arg-Gly-Asp Sequence.
NTIS
Aerospace Medicine; Biomedical Data; Research

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

20030112915 Royal Inst. of Tech., Stockholm, Sweden
Analysis on Leminiscates and Hamburger's Moments
Kuznetsova, O.; Tkachev, V.; Feb. 2003; 48 pp.; In English
Report No.(s): PB2004-100922; TRITA-MAT-03-MA-04; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the following: Introduction; Erdos conjecture; and Main results; Preliminaries: moments systems; M-Systems; and Lambda-moments systems; Averages over harmonic level sets; Lemniscate domains; and Ribbon domains; Proofs of main results; Averages of meromorphic functions; Simple ribbon domains; M-system formalism; Polynomial lemniscates; and Strictly positive functions; Applications; D-functions; and Explicit formulae; Measure op; Representation of op; and Complete monotonicity; References.
NTIS
Moments; Domains; Formalism

20030112916 Royal Inst. of Tech., Stockholm, Sweden
Existence of a Maximal Partial Spread of Size 76 in PG (3,9)
Heden, O.; Marcugini, S.; Pambianco, F.; May 2002; 26 pp.; In English
Report No.(s): PB2004-100924; TRITA-MAT-03-MA-04; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available
Mathematics; Mathematical Models

60
COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

20030113013 Massachusetts Inst. of Tech., Cambridge, MA
Nuclear Magnetic Resonance Spectrometer Console Upgrade for a Type II quantum Computer
Cory, David G.; Nov. 19, 2003; 8 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0250
Report No.(s): AD-A418330; AFRL-SR-AR-TR-03-0477; No Copyright; Avail: CASI; A02, Hardcopy

As proposed, we upgraded the system console on an existing Bruker Instruments, 14 T nuclear magnetic resonance (NMR) spectrometer to enable an improved implementation of type II quantum computers (TTQC). This upgrade is fully functional and has permitted our NMR studies to be moved to higher strength magnetic fields for better sensitivity and spectral dispersion. The TTQC experiments continue in collaboration with Dr. J. Yepez of the Air Force Research Laboratory. We have completed studies of the I-D dynamics of the diffusion equation and the Burger's equation with various viscosity. We have nearly completed additional studies showing both the scaling of errors in TTQC and a new novel mapping to reciprocal space lattices. The latter is hoped to be a first step toward running the TTQC with a closed feedback loop. The closed loop computations will permit continuous quantum computation in a lattice gas architecture.
DTIC
Nuclear Magnetic Resonance; Spectrometers; Quantum Computers

61
COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20030112892 Carnegie-Mellon Univ., Pittsburgh, PA
Viewing Technologies for Computer-Aided Design Models
Potts Steves, Michelle; Frechette, Simon; Foreman, John T.; Anderson, William B.; Sep. 2003; 37 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0003
Report No.(s): AD-A418350; CMU/SEI-2003-TN-022; No Copyright; Avail: CASI; A03, Hardcopy

This report provides information about technologies for viewing computer-aided design (CAD) models. CAD model viewers are tools that allow engineers and other users to view CAD models from distributed locations, often using lightweight viewing applications or standard Web browsers. The report describes factors to consider when choosing a viewing technology, as well as popular CAD model file formats that viewing technologies can import. Also provided is a sampling of commercial off-the-shelf (COTS) products currently available for viewing CAD models; descriptive information for each product, such as basic product functionality, purchase price, computer platform support, file format support; and a related World Wide Web Universal Resource Locator.
DTIC
Computer Aided Design; Viewing; Technologies; Computer Programming

20030112896 Carnegie-Mellon Univ., Pittsburgh, PA
DoD Experience with the C4ISR Architecture Framework
Wood, William G.; Cohen, Sholom; Sep. 2003; 38 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0003
Report No.(s): AD-A418352; CMU/SEI-2003-TN-027; No Copyright; Avail: CASI; A03, Hardcopy

The Department of Defense (DoD) is mandating the use of the Command, Control, Communications, Computer, Intelligence, Surveillance and Reconnaissance Architecture Framework (C4ISRAF) for large-scale software-intensive systems. The authors conducted eight interviews with personnel who have used the C4ISRAF in acquisition projects. The intent of the interviews was to find the strengths and weaknesses of the C4ISRAF, so that this information could be related to future users of the framework. This technical note discusses the context for using the C4ISRAF, the observations made

during the interviews about its use, and the strengths and challenges of using it. Suggestions for overcoming these challenges also are included.
DTIC
Artificial Intelligence; Defense Program; Architecture (Computers)

20030112899 Carnegie-Mellon Univ., Pittsburgh, PA
A Template for Documenting Prediction-Enabled Component Technologies
Merson, Paulo; Oct. 2003; 34 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0003
Report No.(s): AD-A418354; CMU/SEI-2003-TN-030; No Copyright; Avail: CASI; A03, Hardcopy

Prediction-enabled component technology (PECT) is an approach to predicting the behavior of systems built from components with known properties. An important artifact produced by the PECT development process is the documentation of the technologies, tools, and theories as integral elements of the PECT, as well as the results and conclusions of the application of the PECT to a group of systems. This report suggests a template for documenting a PECT. The report also provides guidelines and a few examples to help PECT developers consolidate the broad range of information produced in the PECT development process into a single, organized volume.
DTIC
Computer Programs; Software Engineering

20030112979 Columbia Univ., New York, NY
The Influence of Multimedia-Based Parent and Adolescent Interventions of Substance Abuse Among Poor Youth
Ozanian, Alfred J.; Jan. 2003; 165 pp.; In English
Report No.(s): AD-A418324; AFIT-CI02-1304; No Copyright; Avail: CASI; A08, Hardcopy

Several aspects of an adolescent's life have been shown to be influential in predicting their substance use. However, reaching specific areas of an adolescent's life has been hampered by various environmental and cultural barriers. Today, it may be possible to reach an adolescent, and those around them, with multi-media technologies. This study examines the effectiveness of using multimedia-based interactive technologies coupled with conventional interventions to prevent adolescent substance use. Computer Assisted Skills Training (CAST) interventions with youth, and video and face-to-face interventions with parents, were used to disseminate a science-based substance use prevention program. The enhancement of individual, peer, family, and school protective factors, and the reduction in the incidence of adolescent substance use among low-income African American, Latino, and White adolescents was evaluated. Study participants were predominantly 9-13 years old from low-income, high-risk families that utilized community service organizations in the greater New York City area. Sites included 17 Boys and Girls Clubs of America, 6 Police Athletic Leagues, 9 United Neighborhood House organizations, 5 Independent Service Agencies, and 1 YMCA. Using an experimental design, study sites were stratified by race and then randomly assigned to one of three groups: (1) no intervention control group, (2) CAST only, and (3) parent-CAST group. Adolescents in the parent-CAST group demonstrated improved protective factors and reduced entry level and middle risk drug use compared with the other two study groups. The control group had fewest protective factors and greatest entry level and middle risk substance use. Dose analysis of CAST intervention and parent training revealed the CAST intervention reduced the initiation of substance use. There is anecdotal support that the CAST and parent interventions collectively provided adolescents with greater protection from substance use.
DTIC
Prevention; Computer Aided Design; Drugs; Human Beings; Protection

20030112991 Venice Univ., Italy
Software and Hardware Sound Analysis Tools for Field Work
Pavan, G.; Manghi, M.; Fossati, C.; Jan. 1999; 9 pp.; In English
Report No.(s): AD-A418328; No Copyright; Avail: CASI; A02, Hardcopy

The latest version of the real-time Digital Signal Processing Workstation developed at CIBRA runs in a standard Windows environment and can use a wide range of sound acquisition devices. It can be based on a notebook to allow on- field use. Depending on the acquisition devices, recording, analysis and display can be performed in real-time up to 500 k samples/sec to provide useful bandwidth to more than 200 kHz. The software was primarily developed for continuous real-time monitoring in bioacoustical studies.
DTIC
Computer Programs; Sound Fields; Signal Processing; Electronic Modules

62
COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20030113052 QSS Group, Inc., Moffett Field, CA, USA
Abstract of talk for Silicon Valley Linux Users Group
Clanton, Sam; [2002]; 1 pp.; In English; Silicon Valley Linux Users Group Meeting, 5 Jun. 2002, Moffett Field, CA, USA
Contract(s)/Grant(s): NASA Order H-1059-D; No Copyright; Avail: Other Sources; Abstract Only

The use of Linux for research at NASA Ames is discussed.Topics include:work with the Atmospheric Physics branch on software for a spectrometer to be used in the CRYSTAL-FACE mission this summer; work on in the Neuroengineering Lab with code IC including an introduction to the extension of the human senses project,advantages with using linux for real-time biological data processing,algorithms utilized on a linux system, goals of the project,slides of people with Neuroscan caps on, and progress that has been made and how linux has helped.
Derived from text
Real Time Operation; Spectrometers

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

20030112922 Massachusetts Univ., Amherst, MA
Software, Programming, and Run-Time Coordination for Distributed Robotics
Grupen, Roderic; Oct. 22, 2003; 8 pp.; In English
Contract(s)/Grant(s): DABT63-99-1-0022
Report No.(s): AD-A418204; TR-01; No Copyright; Avail: CASI; A02, Hardcopy

Our project created and disseminated new technologies for coordinating the behavior of large numbers of form factor constrained mobile robots. Simulations and robotic experiments were created to demonstrate coordination constraints expressed in a controlled theoretic framework in a manner that guarantees performance (time, energy, and comm bandwidth), scales to hundreds of individuals, and supports optimization via reinforcement learning to acquire distributed control policies. We have implemented 10 'uBots' to realize our SDR concept on which we have demonstrated adaptive impedance control, multi-robot coordination and dynamic role assignment, a real-time process scheduler, and wearable interfaces. Applications, including: search and mapping; leader-follower control; and multi-robot behavior for preserving network connectivity among coordinated peers. Performance bounds on an n-robot teams using network- distributed interfaces have been demonstrated as well. Twelve students are involved in our SDR project. We ported control code for autonomous grasping and manipulation gaits for robot hands to our colleagues at NASA-JSC for use in the Robonaut program and our simulation for multi-robot search controllers that maintain line of sight was transferred to colleagues at SPAWAR.
DTIC
Robotics; Computer Programs; Real Time Operation; Bandwidth

20030112962 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Improved Target Identification of Correlated Input Data Using Recurrent Neural Networks and Feature Selection
Laine, Trevor I.; Bauer, Kenneth W.; Jun. 12, 2003; 29 pp.; In English
Report No.(s): AD-A418271; No Copyright; Avail: CASI; A03, Hardcopy

For non-cooperative targets, combat ID may be accomplished by fusing data obtained from multiple sensors taken across time periods using ATR algorithms. With some ambiguity existing amongst fusion models, definitions are first developed to identify the specific type of fusion to be performed. Since input features extracted from sensor data for ATR algorithms are likely to contain significant correlation, models such as artificial neural networks that do not assume independent input data are a viable approach for fusion. An experiment was designed to assign generated temporal data with significant autocorrelation, cross correlation and noise into one of two classes. This feasibility study assesses use of an Elman recurrent neural network to perform fusion of multiple sensors with multiple looks to accomplish target identification. To improve classification accuracy, feature saliency screening was performed to select a subset of eight candidate input features with a

signal-to-noise ratio and a network output sensitivity based measure. Both measures indicate a subset of about three of the original eight features should be retained. When comparing the two methods, both selection and ranking of salient features is consistent. Numerical results show the parsimonious subset of features improved generalization by significantly reducing the classification accuracy variance across multiple data sets and through time periods. Additionally, the reduced feature set yields an increase in the observed classification accuracy for the last time period of the external validation set.
DTIC
Neural Nets; Target Recognition; Autocorrelation; Cross Correlation

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20030112971 Washington State Univ., Pullman, WA, USA
Low-Complexity Interior Point Algorithms for Stochastic Programming: Derivation Analysis and Performance Evaluation
Ariyawansa, K. A.; Jan. 2000; 17 pp.; In English
Contract(s)/Grant(s): DAAD19-0O-1-0465
Report No.(s): AD-A418278; ARO-39877.14-MA; No Copyright; Avail: CASI; A03, Hardcopy

The broad purpose of this project was to investigate low-complexity interior point decomposition algorithms for stochastic programming. A specific objective was to evaluate algorithms using test problems arising from useful applications. The important direct results of this project include: (1) a new test problem collection that includes problem instances from a variety of application areas; (2) a new package of C-routines for converting SMPS input data into data structures more suitable for implementing algorithms; (3) a new software package, CPA, for two-stage stochastic linear programs. The test problems and input conversion routines have been developed in a general manner to be useful to other researchers. CPA includes volumetric center algorithms that proved to be successful in our computational evaluations. To the best of our knowledge, CPA is the only software for stochastic programming that includes volumetric center algorithms. Items (1), (2) and (3) are freely accessible over the Internet. The important theoretical results of this project include: (4) a new characterization of convexity-preserving maps; (5) a new coordinate-free foundation for projective spaces; (6) a new geometric characterization of one-dimensional projective spaces; (7) new algorithms for bound-constrained nonlinear optimization. These theoretical results are likely to be useful in computational optimization in general.
DTIC
Stochastic Processes; Algorithms; Parallel Processing (Computers); Performance Tests

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20030112909 Air Force Studies and Analyses Agency, Washington, DC
Improving Aircraft Beddown: Estimates for Conducting Combat Operations
Koewler, David A.; Oct. 31, 2003; 18 pp.; In English
Report No.(s): AD-A418366; No Copyright; Avail: CASI; A03, Hardcopy

To conduct effective combat operations, the Air Force needs to deploy the right mix of aircraft to the right airfield. When too many aircraft are assigned to an airfield, its infrastructure is overwhelmed and aircraft mission effectiveness is degraded. Our current planning capability and our analysis of current and future scenarios must be logistically flexible and robust enough to account for the changes in world politics, where bases we planned to use today might not be available tomorrow. To improve AFSAA's (Air Force Studies and Analyses Agency) capability to quickly estimate beddown plans, we made enhancements to our logistics-planning tool, CBLP (Capabilities Based Logistics Planner). We made it easier to identify potential airfields, and added dynamic tables to display the reduced capabilities of the airfields, as aircraft are bedded down. These enhancements have been used at AFSAA to build more realistic beddown plans for use in our analysis. A web-based version of CBLP is being developed for demonstration in JEFX (Joint Expeditionary Forces Experiment) O4 under the C2 (Command and Control)

Battlelab's Visualization of Expeditionary Sites Tools (VEST) initiative. This paper explains the enhancements made and the heuristic developed to estimate the parking capability of the airfields.
DTIC
Logistics; Heuristic Methods; Military Operations; Combat

20030112957 Georgetown Univ., Washington, DC, USA
Dynamic Spectrum Allocation Algorithms
Kalyanasundaram, Bala; Jan. 2002; 7 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0100
Report No.(s): AD-A418179; AFRL-SR-AR-TR-03-0463; No Copyright; Avail: CASI; A02, Hardcopy

During the current grant period, we considered two things. Our first goal was to provide a simple algorithm for integration into IFDS 2 software that was scheduled to replace IFDS 1. The main purpose of this algorithm is to provide immediate relief. After accomplishing this, we undertook the task of finding techniques to significantly improve effect usage of frequency spectrum. What follows is our preliminary report on our ongoing investigation. The goal of our research is to consider various relaxation of the rigidity of tasks and suggest efficient management algorithm for frequency assignment. There are many ways to relax the rigidity of a task. Observe that there are six numerical information that user provides with each task. We can relax a task by taking any one of this numerical value and change it to an interval where any value in the intervals is acceptable to the user.
DTIC
Algorithms; Spectra; Allocations; Frequency Assignment; Frequency Distribution

20030112968 Illinois Univ., Urbana, IL, USA
A Method for Allocating Financial Resources to Combat Terrorism: Optimizing the Reduction of Consequences
Mackin, T. J.; Henderson, Darrall; Jones, J. W.; Jun. 13, 2003; 18 pp.; In English
Report No.(s): AD-A418274; No Copyright; Avail: CASI; A03, Hardcopy

The National Strategy for Homeland Security established three strategic objectives: (1) Prevent terrorist attacks within the USA, (2) Reduce America's vulnerability to terrorism, and (3) Minimize the damage and recover from attacks that do occur. Objectives 1 and 3 essentially reprogram and reprioritize activities within existing agencies such as the FBI, Customs, the Coast Guard and FEMA, while objective 2 presents an entirely new examination of the Nation's infrastructure. Since the USA cannot counter all possible threats, the Department of Homeland Security is actively developing a risk-based management framework to prioritize vulnerabilities and to fund activities that most effectively reduce the nation's vulnerability to terrorist attack. This paper presents a mathematical framework for resource allocation to decrease America's vulnerability to terrorist attack. The authors introduce mathematical expressions that allow decision makers to allocate resources in a manner that maximizes the reduction in vulnerability to terrorist attack, subject to budget constraints. They introduce a delayed return function that captures the effect of long-term investments in risk- mitigation activities (such as R&D) that may not have a short- term pay-off, but whose long-term contribution is substantial. The method is demonstrated using illustrative scenarios and a linear programming approach.
DTIC
Mathematical Models; Terrorism; Management; Federal Budgets; Decision Support Systems; Risk

20030112969 Army Research Lab., Adelphi, MD
A Sensor Management Model Using Simulation-Based Approximate Dynamic Programming
Bland, William S.; Patek, Stephen D.; Der, Sandor Z.; Oct. 31, 2003; 28 pp.; In English
Report No.(s): AD-A418276; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents a new approach to sensor management of distributed sensor networks (DSNs). Given the current proliferation of remote sensors and their inherent resource constraints, DSN managers face a growing problem of managing the tradeoff between DSN performance and resource consumption. Our model, the Sensor Network Optimal OPerations Simulator, or SNOOPS, addresses this tradeoff by identifying a DSN control strategy that reaches an acceptably certain representation of the search region while minimizing operating costs. The core of the SNOOPS model is an approximate dynamic programming (ADP) process that uses simulation-based policy Iteration to identify an efficient DSN control strategy. Results indicate that the SNOOPS-recommended DSN control strategy improves the efficiency of DSN operations by up to 47 percent over the Base Policy of activating all sensors. In addition to determining efficient DSN control strategies, our model also provides a research base to: (1) investigate the fusion of observations from disparate sensors, (2) demonstrate the use of

non-imaging sensors to provide adequate situational awareness where precision emplacement of more-capable sensors is not possible, and (3) develop operational concepts to integrate DSN operations with user needs.
DTIC
Dynamic Programming; Management; Models; Adaptive Control; Remote Sensors

70
PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics*, or *92 Solar Physics*.

20030112998 Army Research Lab., Aberdeen Proving Ground, MD
Understanding Body-Fixed Sensor Output From Projectile Flight Experiments
Harkins, Thomas E.; Sep. 2003; 33 pp.; In English; Original contains color illustrations
Report No.(s): AD-A418331; ARL-TR-3029; No Copyright; Avail: CASI; A03, Hardcopy

Accurate measurement of in-flight kinematics significantly contributes to the development of experimental projectiles and rockets and to diagnostics for existing munitions and weapons systems. Ground-based instruments such as radar and cameras provide useful measurements but are often limited to portions of a trajectory and/or have limited resolution. On-board sensor systems fixed to a projectile body combined with a telemetry system can provide high resolution continuous data throughout a projectile's entire trajectory. However, there is a twofold difficulty in correctly interpreting and employing data from body-fixed sensors. First, sensor responses many times are affected by stimuli other than those which a sensor is intended to quantify, e.g., an angular rate sensor may be affected by any g forces to which it is subjected. Second, sensor systems often, of necessity, make measurements in a body-fixed coordinate system, and the quantities whose values are desired are best described in another coordinate system. This report treats issues affecting the output of the body-fixed sensors used by the U.S. Army Research Laboratory's Weapons and Materials Research Directorate (Advanced Munitions Concepts Branch) in flight tests of military ordnance and provides the mathematics necessary to transform body-fixed measurements to earth-fixed parameters.
DTIC
Kinematics; Flight Tests; Trajectories; Diagnosis

71
ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20030112911 Pavia Univ., Italy
Effects of Underwater Noise on Marine Mammals
Pavan, Gianni; Feb. 2002; 4 pp.; In English
Report No.(s): AD-A418370; X5-X5; No Copyright; Avail: CASI; A01, Hardcopy

In the Mediterranean Sea marine life is threatened by habitat degradation due to human activities such as fisheries, ship traffic, pollution, and coast anthropization. Other than being effected by chemical pollution, which may contaminate the whole marine food web, cetaceans can also be effected by noise pollution. The underwater environment has its own acoustic peculiarities and cetaceans are extraordinarily well adapted to them. In these mammals, acoustic communication has acquired a privileged role compared with other communication channels. Marine mammals live in a medium which poorly transmits light but through which sound propagates very well, even over long distances. Marine mammals heavily rely on sound to communicate, to exploit and investigate the environment, to find prey and to avoid obstacles. The effect of anthropogenic noise on the marine environment is a new serious concern for scientists.
DTIC
Marine Environments; Underwater Acoustics; Marine Biology

72
ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see *73 Nuclear Physics*.

20030113134 NASA Glenn Research Center, Cleveland, OH, USA

Observations of Glide and Decomposition of a<101> Dislocations at High Temperatures in Ni-Al Single Crystals Deformed along the Hard Orientation

Srinivasan, R.; Daw, M. S.; Noebe, R. D.; Mills, M. J.; February 1, 2003; 13 pp.; In English

Contract(s)/Grant(s): DE-FG02-96ER-45550; RTOP 708-31-13; 22-708-31-02; Copyright; Avail: Other Sources

Ni-44at.% Al and Ni-50at.% single crystals were tested in compression in the hard (001) orientations. The dislocation processes and deformation behavior were studied as a function of temperature, strain and strain rate. A slip transition in NiAl occurs from alpha(111) slip to non-alphaaaaaaaaaaa9111) slip at intermediate temperatures. In Ni-50at.% Al single crystal, only alpha(010) dislocations are observed above the slip transition temperature. In contrast, alpha(101)(101) glide has been observed to control deformation beyond the slip transition temperature in Ni-44at.%Al. alpha(101) dislocations are observed primarily along both (111) directions in the glide plane. High-resolution transmission electron microscopy observations show that the core of the alpha(101) dislocations along these directions is decomposed into two alpha(010) dislocations, separated by a distance of approximately 2nm. The temperature window of stability for these alpha(101) dislocations depends upon the strain rate. At a strain rate of 1.4 x 10(exp -4)/s, lpha(101) dislocations are observed between 800 and 1000K. Complete decomposition of a alpha(101) dislocations into alpha(010) dislocations occurs beyond 1000K, leading to alpha(010) climb as the deformation mode at higher temperature. At lower strain rates, decomposition of a alpha(101) dislocations has been observed to occur along the edge orientation at temperatures below 1000K. Embedded-atom method calculations and experimental results indicate that alpha(101) dislocation have a large Peieris stress at low temperature. Based on the present microstructural observations and a survey of the literature with respect to vacancy content and diffusion in NiAl, a model is proposed for alpha(101)(101) glide in Ni-44at.%Al, and for the observed yield strength versus temperature behavior of Ni-Al alloys at intermediate and high temperatures.

Author

Decomposition; High Temperature; Nickel Aluminides; Crystal Dislocations; Single Crystals

74
OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*. For lasers see *36 Lasers and Masers*.

20030112912 South Carolina Univ., Columbia, SC

Multilayer Optical Filters for Automatic Detection of Analytes in Mixtures with Interferrants - Basic Research in Materials and Techniques

Myrick, Michael L.; May 2003; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-00-2-6059; Proj-0600

Report No.(s): AD-A418372; AFRL-HE-WP-TR-2003-0065; No Copyright; Avail: CASI; A03, Hardcopy

Research during the second year of the USC optical computing project demonstrated that imaging multivariate optical elements (IMOEs) could be designed, fabricated and characterized. Results of the first MOE tests showed that the angle-independent performance anticipated in Y1 of this project is a practical possibility. Measurements were made on the UV-Vis, near-infrared and mid-infrared spectral characteristics of one bacterial spores type, specifically, the bacillus, BG, and comparisons to papers of many types were made. The results showed that these spores were distinguishable from typical papers in the UV-blue region, the 1500 nm region, and throughout the mid-IR. A prototype camera system based on an IMOE was constructed and demonstrated to work in the UV-Vis region.

DTIC

Optical Filters; Automatic Control; Detection

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20030113136 Massachusetts Inst. of Tech., Cambridge, MA, USA
Study of the Helicon Source Operation in the Variable Specific Impulse Magnetoplasma Rocket (VASIMR) Experiment
Molvig, Kim; Batishchev, Oleg; [2003]; 37 pp.; In English
Contract(s)/Grant(s): NAG9-1455; No Copyright; Avail: CASI; A03, Hardcopy

During this research period the following models of the VASIMR helicon discharge have been further developed and applied to analyze the on-going VX- 10 ASPL experiment: A) 1D semi-analytical model for a mixed-collisional propellant flow B) OD power and balance model for the whole helicon discharge In this particular research period we have concentrated on the MW-level performance of the VASIMR helicon source. Favorable high-power scaling and reduced ionization costs were obtained, and presented at the VASIMR NASA review in the Fall '02. This Grant is continuation of the previous NAG9-1224 award. The research results are summarized in 14 publications; they were presented as 20+ talks at the major International Conferences and scientific seminars at the leading Academic and Research Institutions. The reported results allowed helicon discharge characterization, understanding of the several experimental observations, and helped to make predictions and propose structural modifications for the advanced VASIMR helicon source operation.
Author
Vasimr (Propulsion System); Magnetohydrodynamic Flow

76
SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering*; and *36 Lasers and Masers*.

20030113046 NASA Marshall Space Flight Center, Huntsville, AL, USA
Growing Larger Crystals for Neutron Diffraction
Pusey, Marc; [2003]; 1 pp.; In English; 5th International Symposium on Organized Research Combination System, 19-21 Nov. 2003, Ibaraki, Japan; No Copyright; Avail: Other Sources; Abstract Only

Obtaining crystals of suitable size and high quality has been a major bottleneck in macromolecular crystallography. With the advent of advanced X-ray sources and methods the question of size has rapidly dwindled, almost to the point where if one can see the crystal then it was big enough. Quality is another issue, and major national and commercial efforts were established to take advantage of the microgravity environment in an effort to obtain higher quality crystals. Studies of the macromolecule crystallization process were carried out in many labs in an effort to understand what affected the resultant crystal quality on Earth, and how microgravity improved the process. While technological improvements are resulting in a diminishing of the minimum crystal size required, neutron diffraction structural studies still require considerably larger crystals, by several orders of magnitude, than X-ray studies. From a crystal growth physics perspective there is no reason why these 'large' crystals cannot be obtained: the question is generally more one of supply than limitations mechanism. This talk will discuss our laboratory s current model for macromolecule crystal growth, with highlights pertaining to the growth of crystals suitable for neutron diffraction studies.
Author
Crystal Growth; Macromolecules; Crystallography; Neutron Diffraction

80
SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula. For specific topics in these areas see *categories 81 through 85*.

20030113157 NASA Dryden Flight Research Center, Edwards, CA, USA
Web-Based Instruction and Learning: Responding to K-14 Customer Needs
McCarthy, Marianne; Grabowski, Barbara; Koszalka, Tiffany; Peck, Christa; December 2003; 143 pp.; In English; Web-Based Instruction and Learning: Responding to K-14 Customer Needs, 23-25 Sep. 1997, Cleveland, OH, USA; Original contains color illustrations
Report No.(s): NASA/CP-2003-210722; H-2449; NAS 1.55:210722; No Copyright; Avail: CASI; A07, Hardcopy

A follow-up working conference was held at Lewis Research Center (now Glenn Research Center) on September 23-25, 1997, to continue discussing issues related to the development of Web-based education materials for the K-14 community. The conference continued the collaboration among the NASA aerospace technology Centers (Ames, Dryden, Langley, and Lewis [now Glenn]), NASA Headquarters, the University of Idaho and the Pennsylvania State University. The conference consisted of presentations by the Aeronautics Cooperative Agreement teams, and working sessions that addressed issues related to the conference theme, responding to the K-14 customers needs. The group identified the most significant issues by consensus. The issues addressed were: classroom access, World Wide Web resources, teacher training, different teaching and learning styles, interactivity, and education standards. The working sessions produced observations and recommendations in each of these areas in order to work toward the goal of making NASA sponsored Web-based educational resources useful to teachers and students.
Author
Education; World Wide Web

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20030113145 NASA Glenn Research Center, Cleveland, OH, USA
Concurrent and Collaborative Engineering Implementation in an R and D Organization
DelRosario, Ruben; Davis, Jose M.; Keys, L. Ken; August 15, 2003; 5 pp.; In English; 2003 IEEE International Engineering Management Conference: Managing Technologically-Driven Organizations, 1-3 Nov. 2003, Albany, NY, USA
Contract(s)/Grant(s): WBS 22-080-50-20; No Copyright; Avail: CASI; A01, Hardcopy

Concurrent Engineering (CE), and Collaborative Engineering (or Collaborative Product Development - CPD) have emerged as new paradigms with significant impact in the development of new products and processes. With documented and substantiated success in the automotive and technology industries CE and, most recently, CPD are being touted as innovative management philosophies for many other business sectors including Research and De- velopment. This paper introduces two independent research initiatives conducted at the NASA Glenn Research Center (GRC) in Cleveland, Ohio investigating the application of CE and CPD in an RdiD environment. Since little research has been conducted in the use of CE and CPD in sectors other than the high mass production manufacturing, the objective of these independent studies is to provide a systematic evaluation of the applicability of these paradigms (concur- rent and collaborative) in a low/no production, service environment, in particular R&D.
Author
Concurrent Engineering; Product Development

82
DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see *61 Computer Programming and Software*.

20030112914 Northrop Grumman Corp., El Segundo, CA, USA
Quality of Information Metrics for Autonomous Decision Marking
Purtell, Russell; Prasanth, Ravi; Cabrera, Joao; Mehra, Raman; Smith, Robert; Sep. 2003; 23 pp.; In English
Contract(s)/Grant(s): F33615-02-C-3207; Proj-2403
Report No.(s): AD-A418371; AFRL-VA-WP-TM-2003-3074; No Copyright; Avail: CASI; A03, Hardcopy

This effort explores the management of information flows in a UAV. It is research into the information requirements for flying a UAV and how the quality of that information might be ascertained. This presentation looks at early results using information theory constructs to evaluate different information flows.
DTIC
Decision Making; Information Theory; Autonomy

20030112973 Naval Postgraduate School, Monterey, CA

Design of an Effective Visualization for Naval Career Information Summary and Evaluation

Rogers, Glenn A.; Grose, Jason D.; Sep. 2003; 99 pp.; In English; Original contains color illustrations

Report No.(s): AD-A418281; No Copyright; Avail: CASI; A05, Hardcopy

By using visualization best practices and embedding them in information technology (IT), we believe that the Department of Defense can improve its ability to display multi-variant information. The focus of this research is to design a visual information solution, based on best practices for displaying performance data visually, to the Electronic Military Personnel Record System (EMPRS). Ultimately, our goal is to improve the overall effectiveness and objectivity of the Navy's selection board processes by providing a re-engineered, web-based, graphical solution to the visual displays currently in use by selection boards. The current Navy selection board voting process uses tabular forms displayed across five screens in a small theater-like setting. The forms are displayed very quickly allowing board members very little time to mentally assimilate the quantitative data dispersed over a wide area.

DTIC

Personnel Selection; Selection; Design Analysis; Effectiveness; Visual Perception

20030113005 Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA

US Army Research Institute Program in Basic Research 2002-2003

Nov. 2003; 85 pp.; In English

Report No.(s): AD-A418333; ARI-RN-2004-01; No Copyright; Avail: CASI; A05, Hardcopy

This document contains detailed summaries for each of the U.S. Army Research Institute's basic research contracts for the fiscal years 1998 - 2003. These summaries are grouped according to three Basic Research Office program objectives: Providing fundamental knowledge to improve training in complex, digital environments; providing fundamental knowledge to improve leader assessment and accelerate leader development; and providing fundamental knowledge for identifying and measuring the attributes and skills that are critical to soldier recruiting, performance, and retention in the transforming Army. In addition to summarizing what was done or is being done, each summary also describes the contributions of that research effort to basic behavioral science and suggests how the findings might benefit the Army and other military services.

DTIC

Education; Research; Armed Forces

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20030113131 California Inst. of Tech., Pasadena, CA, USA

Dense Molecular Clumps in the Orion Bar Photo Dominated Region

Lis, D. C.; Schilke, P.; [2003]; 12 pp.; In English

Contract(s)/Grant(s): NSF AST-22-09008

Report No.(s): Rept-2003-3; No Copyright; Avail: CASI; A03, Hardcopy

We present high angular resolution observations of the Orion Bar photon dominated region (PDR) in optically thin H-13CN and H-13CO(+) (1-0) lines, obtained using the IRAM Plateau de Bure interferometer. At least ten spatially resolved molecular condensations are identified in the H-13CN image with virial masses in the range 0.5 - 1.5 solar mass. The median value of their H2 volume density, approx. 6 x l0(exp 6)/cu cm, is a factor of approx. 4 higher than the estimate based on previous PDR modeling of the main isotopomers of HCN and HCO(+). Since optically thin H-13CN emission is likely to trace the densest gas in the clump interiors, as compared to the main isotopomer, the H-13CN clumps appear to be close to virial equilibrium. The H-13CN fractional abundance is a factor of approx. 8 lower than that in the Orion Ridge, well shielded from the far-ultraviolet (FUV) photons (approx. 1 x l0(exp -10). The H-13CN condensations can be described in the framework of models of photoevaporating clumps exposed to an intense flux of FUV photons. The derived clump parameters are consistent with models of clumps of turbulent origin that evolve, so that their column densities are equal to the critical value determined by the incident FUV field. In this case, the column densities of the H-13CN clumps seem high enough so that gravitational collapse can be triggered by the FUV-driven shock wave compression. The clumps may thus be collapsing to form low-mass stars. The observed H-13CN clump parameters are also consistent with pressure-confined clump models. However, in this case

the clumps would not be virialized and susceptible to gravitational collapse.
Author
Angular Resolution; Clumps; Gas Density; High Resolution; Trace Contaminants

20030113135 NASA Goddard Space Flight Center, Greenbelt, MD, USA
RXTE and BeppoSAX Observations of MCG-5-23-16: Reflection From Distant Cold Material
Mattson, B. J.; Weaver, K. A.; [2003]; 17 pp.; In English
Contract(s)/Grant(s): NAG5-4626; No Copyright; Avail: CASI; A03, Hardcopy

We examine the spectral variability of the Seyfert 1.9 galaxy MCG-5-23-16 using RXTE and BeppoSAX observations spanning 2 years from April 1996 to April 1998. During the first year the X-ray source brightens by a factor of approximately 25% on timescales of days to months. During this time, the reprocessed continuum emission seen with RXTE does not respond measurably to the continuum increase. However, by the end of the second year during the BeppoSAX epoch the X-ray source has faded again. This time, the reprocessed emission has also faded, indicating that the reprocessed flux has responded to the continuum. If these effects are caused by time delays due to the distance between the X-ray source and the reprocessing region, we derive a light crossing time of between approximately 1 light day and approximately 1.5 light years. This corresponds to a distance of 0.001 pc to 0.55 pc, which implies that the reprocessed emission originates between 3 x 10(exp 15) cm and 1.6 x 10(exp l8) cm from the X-ray source. In other words, the reprocessing in MCG-5-23-16 is not dominated by the inner regions of a standard accretion disk.
Author
X Ray Timing Explorer; Seyfert Galaxies; X Ray Spectra; Reflection

20030113137 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Transient Relativistically-Shifted Lines as a Probe of Black Hole Systems
Turner, T. J.; Kraemer, S. B.; Reeves, J. N.; [2003]; 7 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

X-ray spectra of Seyfert-type Active Galaxies have revealed a new type of X-ray spectral feature, one which appears to offer important new insight into the black hole system. XMM revealed several narrow emission lines redward of Fe Kalpha in NGC 3516. Since that discovery in NGC 3516, the phenomenon has been observed in other Seyfert galaxies, e.g. NGC 7314 and ESO 198-G24. We present new evidence for a redshifted Fe line in XMM spectra of Mrk 766. These data reveal the first evidence for a significant shift in the energy of a redshift Fe line, the shift occurs over just a few tens of kiloseconds. This shift may be interpreted as deceleration of ejected gas, the velocity of the material lies just above the escape velocity at the implied radial location of the emitter.
Author
Black Holes (Astronomy); Line Spectra; Seyfert Galaxies; X Ray Spectra; Red Shift; Relativistic Effects

20030113140 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Radio Afterglow of GRB030329 at Centimetre Wavelengths: Evidence for Multiple Jets or a Structured Jet, Chapter 6
Rol, E.; vanderHorst, A. J.; Wijers, R. A. M. J.; Strom, R.; Kaper, L.; Kouveliotou, C.; vandenHeuvel, E. P. J.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We present our centimetre wavelength (1.4, 2.3 and 4.9 GHz) light curves of the afterglow of GRB030329, which were obtained with the Westerbork Synthesis Radio Telescope. Modelling the data according to a collimated afterglow results in a jet-break time t(sub j) of 17 days. This is in contrast with earlier results obtained at higher frequencies, which indicate t(sub j) to be around 10 days. Furthermore, with respect to the afterglow model, some additional flux at the lower frequencies is present when these light curves reach their maximum. We subsequently show that the afterglow can be modelled with two or more components with progressively later jet breaks. From these results we infer that the jet is in fact a structured or a layered jet, where the ejecta with lower Lorentz factors produce additional flux which becomes visible at late times in the lowest frequency bands.
Author
Radio Astronomy; Centimeter Waves; Afterglows; Jet Flow

20030113141 NASA Marshall Space Flight Center, Huntsville, AL, USA
Chandra Observations of the Faintest Low-Mass X-Ray Binaries
Wilson, Colleen A.; Patel, Sandeep K.; Kouveliotou, Chryssa; Jonker, Peter G.; vanderKlis, Michiel; Lewin, Walter H. G.; Belloni, Tomaso; Mendez, Mariano; Astrophysical Journal; October 20, 2003; Volume 596, pp. 1220-1228; In English
Contract(s)/Grant(s): GO0-1054A; GO2-3046B; Copyright; Avail: Other Sources

A group of persistently faint Galactic X-ray sources exist that, based on their location in the Galaxy, high L(sub X)/L(sub opt), association with X-ray bursts, and absence of low-frequency X-ray pulsations, are thought to be low-mass X-ray binaries (LMXBs). We present results from Chandra observations for eight of these systems: 4U 1708-408, 2S 1711-339, KS 1739-304, SLX 1735-269, GRS 1736-297, SLX 1746-331, 1E 1746.7-3224, and 4U 1812-12. Locations for all these sources, excluding GRS 1736-297, SLX 1746-331, and KS 1739-304 (which were not detected), were improved to 0.6 sec error circles (90% confidence). Our observations support earlier findings of transient behavior of GRS 1736-297, KS 1739-304, SLX 1746-331, and 2S 1711-339 (which we detect in one of two observations). Energy spectra for 4U 1708-408, 2S 1711-339, SLX 1735-269, 1E 1746.7-3224, and 4U 1812-12 are hard, with power-law indices typically 1.4-2.1, which is consistent with typical faint LMXB spectra.
Author
X Ray Astronomy; Milky Way Galaxy; X Ray Sources; X Ray Binaries

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20030112997 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Massive Warm Baryonic Halo in the Coma Cluster
Bonamente, Massimiliano; Joy, Marshall K.; Lieu, Richard; The Astrophysical Journal; March 10, 2003; Volume 585, pp. 722-729; In English; Copyright; Avail: Other Sources

Several deep PSPC observations of the Coma Cluster reveal a very large scale halo of soft X-ray emission, substantially in excess of the well-known radiation from the hot intracluster medium. The excess emission, previously reported in the central region of the cluster using lower sensitivity Extreme Ultraviolet Explorer (EUVE) and ROSAT data, is now evident out to a radius of 2.6 Mpc, demonstrating that the soft excess radiation from clusters is a phenomenon of cosmological significance. The X-ray spectrum at these large radii cannot be modeled nonthermally but is consistent with the original scenario of thermal emission from warm gas at approx. 10(exp 6) K. The mass of the warm gas is on par with that of the hot X-ray-emitting plasma and significantly more massive if the warm gas resides in low-density filamentary structures. Thus, the data lend vital support to current theories of cosmic evolution, which predict that at low redshift approx. 30%-40% of the baryons reside in warm filaments converging at clusters of galaxies.
Author
Baryons; Galactic Clusters; Galactic Halos; X Ray Astronomy

20030113002 Massachusetts Inst. of Tech., Cambridge, MA, USA
Modeling the Extended Neutral Atmosphere and Plasma Environment near Saturn
Richardson, John D.; [2003]; 3 pp.; In English
Contract(s)/Grant(s): NAG5-8947; No Copyright; Avail: CASI; A01, Hardcopy

In the three years of this study we have published five papers in refereed journals. We have first examined satellite sources and their contribution to the observed neutral cloud. Based on the total calculated satellite sources and the spatial distribution of sputtered H20, we concluded that they cannot produce observed OH cloud. The E-ring contribution has been also studied in detail.In order to produce observed OH cloud we suggested that the E-ring might be the dominant source in inner Saturnian magnetosphere. We proposed a possible resupply mechanism which is needed to keep both E-ring and OH cloud in the present state: collisions between E-ring grains and remains of a disrupted satellite near Enceladus Lagrangian points. In this scenario a large amount of material, ranging from a few micrometers to hundred of meters, which is optically invisible at present, is likely to exist there. The fourth paper compares the magnetosheaths of the outer planets. A surprising result is that the hot proton component comprises about 40% of the total density, much larger than predicted by shock theory. Gas dynamic models of the boundaries show that the magnetospheres of Jupiter and Saturn are flattened at the poles. The last paper was published in GRL and is the first based of the model of neutrals developed as a main goal of this grant and which is now operational.This Monte Carlo collision code self- consistently determines the neutral distribution. from the rings and satellites until they are lost by ionization, by collisions with rings, moons, or Saturn, or by escape from Saturn. Our model is unique in that it includes the effects of plasma chemistry and both plasma-neutral and neutral neutral collisions to determine the dynamical evolution of the water group neutrals in Saturn's magnetosphere. The lifetimes of the neutrals against loss to photoionization, charge exchange, electron dissociation and electron impact dissociation are based on the model given by (Richardson et al. 1998) and

vary with position in the magnetosphere. The dominant neutral dissociation channels H20->OH+H, H20-> O+H2, and OH->O+H2 are considered.
Derived from text
Saturn (Planet); Planetary Magnetospheres

20030113109 Space Telescope Science Inst., Baltimore, MD, USA
Physical Studies of Brown Dwarfs and Extrasolar Planets
Boyce, Joseph, Technical Monitor; Noll, Keith; September 12, 2003; 2 pp.; In English
Contract(s)/Grant(s): NAG5-8314; STScI Proj. J0179; No Copyright; Avail: CASI; A01, Hardcopy

The primary activities supported under this grant included research into the mid-infrared spectral properties of brown dwarfs, with particular emphasis on the 3-4 micron region, the L band. Several observing trips were made to use facilities on Mauna Kea. The primary discovery was the detection of absorption due to CH4 in several L dwarfs, including one classified as an L5. This is significant since CH4 is usually considered to be the defining characteristic of T dwarfs. The stronger fundamental band at 3.3um, however, makes it possible to observe the emergence of CH4 at hotter temperatures. A secondary result of this work is the surprising weakness of the CH4 nu3 band. This can be interpreted as either an indication that derived effective temperatures are too low, or perhaps, that the equilibrium abundance of CH4 is suppressed due to non-equilibrium processes at work in the atmosphere.
Author
Brown Dwarf Stars; Methane

20030113139 NASA Marshall Space Flight Center, Huntsville, AL, USA
Non-Thermal Hard X-Ray Emission in Galaxy Clusters Observed with the BeppoSAX PDS
Nevalainen, J.; Oosterbroek, T.; Bonamente, M.; Colafrancesco, S.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We study the X-ray emission in a Sample of galaxy clusters using the BeppoSAX PDS instrument in the 20 - 80 keV energy band. We estimate the non-thermal hard X-ray cluster emission (HXR) by modeling the thermal contribution from the cluster gas and the non-thermal contamination from the unobscured AGN in the clusters. We also evaluate the systematic uncertainties due to the background fluctuations. Assuming negligible contamination from the obscured AGN, the resulting non-thermal component is detected at a 2 sigma level in approx. 50% of the non-significantly AGN-contaminated clusters: A2142, A2199, A2256, A3376, Coma, Ophiuchus and Virgo. The data are consistent with a scenario whereby relaxed clusters have no hard X-ray component of non-thermal origin, whereas merger clusters do. The co-added spectrum of the above clusters indicates a power-law spectrum for the HXR with a photon index of 2.8+0.3-0.4 in the 12 - 115 keV band, and we find indication that it has extended distribution. These indications argue against significant contamination from obscured AGN, which have harder spectra and centrally concentrated distribution. These results are supportive of the assumption of the merger shock acceleration of electrons in clusters, which has been proposed as a possible origin of the non-thermal hard X-ray emission models. Assuming that the Cosmic Microwave Background photons experience Inverse Compton scattering from the merger-accelerated relativistic electrons, and thus produce the observed HXR, the measured hard X-ray slope corresponds to a differential momentum spectra of the relativistic electrons with a slope of mu = 3.8 - 5.0. In presence of cluster magnetic fields this relativistic electron population produces synchrotron emission with a spectral index of 1.4 - 2.1, consistent with radio halo observations of merger clusters. Thus both hard X-ray and radio observations of merger clusters are consistent with the Inverse Compton model. The observed slope of HXR is also consistent with that predicted by the non-thermal bremsstrahlung, which chus cannot be ruled by the fit to the current data, even though this model requires an extreme, untenable cluster energetics. Assuming centrally concentrated distribution of HXR, the data requires a harder slope for the HXR spectrum, which is consistent with secondary electron models, but this model yields a worse fit to the PDS data and thus seems to be disfavored over the primary electron Inverse Compton model.
Author
X Ray Astronomy; Emission; Galactic Clusters

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SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20030113042 Massachusetts Inst. of Tech., Cambridge, MA, USA
High-Time-Resolution Study of Magnetic Holes in the Solar Wind
Lazarus, Alan; Kasper, Justin; Stevens, Michael; January 2003; 3 pp.; In English
Contract(s)/Grant(s): NAG5-12793
Report No.(s): MIT-OSP-6894461; No Copyright; Avail: CASI; A01, Hardcopy

The objectives of this investigation are to determine the internal plasma structure of kinetic-scale and larger scale magnetic holes, and to determine their stability, their source mechanism(s), and their spatial extent. It is also of importance to determine the relationship between kinetic-scale holes and long-duration holes. As smaller and smaller magnetic depressions are investigated in order to make this a complete study, a robust criterion is necessary for distinguishing magnetic holes from random or unresolvable fluctuations in the interplanetary magnetic field. In order to resolve this ambiguity, we obtained from the MFI experiments magnetic field measurements from the WIND spacecraft at a time resolution of 46 to 184 ms over certain periods. We have also devised a measure of certainty for magnetic hole detections. The certainty factor, q, is defined as the difference between the mean magnetic field in the hole and the local magnetic field, in units of the local standard deviation of the field strength. For fullest generality, it is necessary to calculate this q over the range of available scales of interest, from 60 ms up to 300 s. This technique establishes a two dimensional matrix of relative probabilities that a hole of some duration (d) might exist in the data set at a given time (t). In identifying q-peaks in time and duration, we also come upon a natural method for distinguishing holes with internal structure from multiple holes in close proximity or holes nested inside of others. If two q-peaks are more than a half-width apart, they are simply said to be separate events.
Derived from text
Solar Wind; Solar Magnetic Field; Magnetic Measurement

93
SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see 52 Aerospace Medicine. For theory see *73 Nuclear Physics*.

20030112835 NASA Glenn Research Center, Cleveland, OH, USA
Thermal Contributions to the Degradation of Ground Laboratory and Space Irradiated Teflon
deGroh, Kim K.; Martin, Morgana; [2003]; 34 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

The aluminized Teflon fluorinated ethylene propylene outer most layer of the multilayer insulation blankets on the Hubble Space Telescope has become embrittled resulting in severe on-orbit cracking. During the second servicing mission, a piece of aluminized fluorinated ethylene propylene was retrieved that had curled, exposing the back-surface aluminum to space. This extremely embrittled piece reached 200 C on-orbit, 150 C higher than the nominal temperature extreme. Therefore, experiments have been conducted to determine the effect of heating on the degradation of fluorinated ethylene propylene that has been irradiated in a ground laboratory facility or in space on Hubble Space Telescope. Samples of pristine, x-ray irradiated and Hubble Space Telescope retrieved fluorinated ethylene propylene were heat treated from 50 to 200 C at 25 C intervals in a high vacuum facility and tensile tested. Density measurements were also obtained. Results indicate that heating does not embrittle non-irradiated Teflon. However, there is a significant dependence of the embrittlement of irradiated Teflon on heating temperature, with near complete loss of elongation at 100 C and higher. Rate of degradation changes, which were consistent with the glass transition temperature for fluorinated ethylene propylene, were present in the data. The results support chain scission as the primary mechanism of degradation of fluorinated ethylene propylene on Hubble Space Telescope, and indicate the significance of the on-orbit temperature of fluorinated ethylene propylene with respect to its degradation in the space environment.
Author
Degradation; Teflon (Trademark); X Ray Irradiation; Space Missions; Temperature Effects

20030112873 NASA Marshall Space Flight Center, Huntsville, AL, USA

Multiparametric Determination of Radiation Risk

Richmond, Robert C.; [2003]; 1 pp.; In English; NASA Cell Science Conference, 26-28 Feb. 2003, Palo Alto, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Predicting risk of human cancer following exposure to ionizing space radiation is challenging in part because of uncertainties of low-dose distribution amongst cells, of unknown potentially synergistic effects of microgravity upon cellular protein-expression, and of processing dose-related damage within cells to produce rare and late-appearing malignant transformation, degrade the confidence of cancer risk-estimates. The NASA- specific responsibility to estimate the risks of radiogenic cancer in a limited number of astronauts is not amenable to epidemiologic study, thereby increasing this challenge. Developing adequately sensitive cellular biodosimeters that simultaneously report 1) the quantity of absorbed close after exposure to ionizing radiation, 2) the quality of radiation delivering that dose, and 3) the risk of developing malignant transformation by the cells absorbing that dose could be useful for resolving these challenges. Use of a multiparametric cellular biodosimeter is suggested using analyses of gene-expression and protein-expression whereby large datasets of cellular response to radiation-induced damage are obtained and analyzed for expression-profiles correlated with established end points and molecular markers predictive for cancer-risk. Analytical techniques of genomics and proteomics may be used to establish dose-dependency of multiple gene- and protein- expressions resulting from radiation-induced cellular damage. Furthermore, gene- and protein-expression from cells in microgravity are known to be altered relative to cells grown on the ground at 1g. Therefore, hypotheses are proposed that 1) macromolecular expression caused by radiation-induced damage in cells in microgravity may be different than on the ground, and 2) different patterns of macromolecular expression in microgravity may alter human radiogenic cancer risk relative to radiation exposure on Earth. A new paradigm is accordingly suggested as a national database wherein genomic and proteomic datasets are registered and interrogated in order to provide statistically significant dose-dependent risk estimation of radiogenic cancer in astronauts.

Author

Extraterrestrial Radiation; Ionizing Radiation; Radiogenic Materials; Radiation Dosage

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